UNIVERSITY
OF FLORIDA
LIBRARIES

1853

Digitized by the Internet Archive
in 2010 with funding from
Lyrasis Members and Sloan Foundation

http://www.archive.org/details/aphasiaclinicalp00weis

APHASIA

A CLINICAL AND PSYCHOLOGICAL STUDY

by Theodore Weisenburg, M.D.

and Katharine E. McBride, Ph.D.

NEW YORK
THE COMMONWEALTH FUND
London · Humphrey Milford · Oxford University Press
1935

COPYRIGHT, 1935, BY THE COMMONWEALTH FUND

PUBLISHED SEPTEMBER, 1935

133.155
L8497a
c. 2

University of Florida
1853

THE COMMONWEALTH FUND, 41 EAST 57TH ST., NEW YORK, N.Y.

PRINTED BY E. L. HILDRETH & CO., INC., BRATTLEBORO, VERMONT

This study of aphasia was undertaken in 1929, with the assistance of a grant from the Commonwealth Fund, by Dr. Theodore Weisenburg, Professor of Neurology, Graduate School of Medicine, University of Pennsylvania, and Editor-in-Chief of the Archives of Neurology and Psychiatry. Dr. Weisenburg had for many years been interested in the subject of aphasia and devoted practically his entire attention to this study during the last years of his life. The completed manuscript was submitted for publication only a few weeks prior to Dr. Weisenburg's death.

(Counseling Center to C.L. 5/1/68)

PREFACE

IT may be of some interest to detail the inception of this study. Six years ago while training ten graduate students in neuropsychiatry in the Graduate School of Medicine, University of Pennsylvania, two of the students, Pearson and Alpers[1] were directed to try out Head's tests for aphasia on the other students. To their amazement and mine, the results of some of the tests were similar to those obtained by Head in his aphasic patients. In other words, it seemed obvious that these tests were not simply language tests. It should be emphasized that eight of these students were Commonwealth Fund fellows, who had been selected from over a hundred candidates by a board of physicians, that is, they were of superior intelligence. Another series of tests was tried out with similar results.

The need for adequate test methods for the study of aphasia seemed obvious, and I determined to embark on this research. The Commonwealth Fund of New York City generously financed a three-year plan. Actually the work has taken five years.

The book contains the report of the research in which 234 patients were examined by a battery of psychological tests. These were carefully selected from the mental and educational achievement tests in common use and from the specific tests for aphasia suggested in the literature. In the course of the study it was necessary to add new tests. Inasmuch as there were no facts as to the behavior of normal adults on most of the tests, a group of 85 adults was subjected to the same battery. The results of this study furnish a comparative value to the tests used with the aphasic and other cerebral lesion patients, and are the subject of a separate publication.[2]

Sixty clear-cut cases of aphasia were chosen as the basis of the critical study found in the text. It is hardly necessary to point out that these patients were studied from both the neurological and psychiatric angles, but the psychological viewpoint is emphasized throughout, for the chief object of this research was to demonstrate the actual mental changes present in aphasia.

I was fortunate in the very beginning to obtain the cooperation of Katharine E. McBride, Ph.D., who was placed in charge of the psychological aspect of the work. Mildred Willard Gardiner, M.A., and Anne Roe, Ph.D., psychologists, also cooperated, Mrs. Gardiner in the first three years and Miss Roe in the last two. Dr. Bernard J. Alpers assisted in the survey of the literature and examined most of the aphasic cases from the neurological standpoint. This research could not have been brought to a successful conclusion without their work, and it is a pleasure to acknowledge it.

---

[1] G. H. J. Pearson, B. J. Alpers, and T. Weisenburg, *Aphasia: A Study of Normal Control Cases,* Arch. Neur. & Psychiat., 1928, 19, 281–295.

[2] T. Weisenburg, A. Roe, and K. E. McBride, *Adult Intelligence* (New York: The Commonwealth Fund).

A preliminary analysis of the findings from the psychological angle, entitled *A Psychological Study of Aphasia* and based on the results of the first forty aphasic cases, was prepared by Miss McBride in 1932. This dissertation was accepted by Bryn Mawr College in partial fulfilment of the requirements for the degree of doctor of philosophy.

Most of the patients were selected from the Orthopedic Hospital and Infirmary for Nervous Diseases, from the services of Dr. Charles W. Burr and Dr. Francis Sinkler; the University Hospital, which furnished most of the brain tumor cases, from the services of Dr. Charles H. Frazier and Dr. William G. Spiller; the Philadelphia General Hospital, whose famous nervous wards, founded by Dr. Charles K. Mills, are always a source of interesting material, and from which came most of the chronic vascular patients from the services of Drs. J. W. McConnell, George Wilson, A. M. Ornsteen, C. A. Patten, J. C. Yaskin, and B. J. Alpers; the Graduate Hospital of the University of Pennsylvania, service of Dr. Francis C. Grant; St. Joseph's Hospital, service of Dr. J. C. Flynn; Temple University Hospital, service of Dr. N. W. Winkelman, and from many other sources. I am indebted to all these gentlemen for their cooperation and kindness in placing their patients at my disposal for study.

The book in its final form with twenty chapters deals with most of the aspects of the aphasia problem; some of the subjects discussed are still under investigation, notably the characteristics of the hemiplegics who have recovered from aphasia or did not have it at all, and the apraxias and agnosias.

Finally I am indebted to my two secretaries, Elita Sachse, who is also responsible for the drawings, and Margaret Moore. Their faithful cooperation over many years makes an acknowledgment of their work a source of great pleasure.

T. W.

July, 1934

CONTENTS

Preface vii

I. Introduction 1

II. The History of Aphasia: A Critical Survey of Early Work 6
  1. Trends in research 6
  2. Early work 8

III. The History of Aphasia: A Critical Survey of Modern Work 28
  1. The structural approach 28
  2. The nature of aphasia 34
  3. Types of aphasia 47

IV. The History of Aphasia: Special Problems 83
  1. Tests and examination methods 83
  2. Improvement and reeducation 92
  3. Apraxia and agnosia 100
  4. Amusia 116

V. The Patients Studied in This Research 119
  1. The selection of the groups 119
  2. Comparative data 122
  3. The aphasic group 130
  4. Summary 130

VI. Tests and Examination Methods Used 132
  1. Psychological examinations for aphasic patients: a discussion of the essential requirements 132
  2. Outline of the principal tests 134
  3. Discussion of general method 137
  4. Summary 139

VII. A Classification of Types of Aphasia 141
  1. The problem of classification 141
  2. The classification adopted 143
  3. Summary 147

VIII. Types of Aphasia: The Expressive 148
1. The nature of the expressive disorders 148
2. A simple disorder: Case No. 33 154
3. A more complex disorder: Case No. 4 160
4. Other variations within the expressive disorders: Cases Nos. 50 and 6 182
5. A complex disorder with severe disturbances in writing: Case No. 16 195
6. Summary 211

IX. Types of Aphasia: The Receptive 213
1. The nature of the receptive disturbances 213
2. The nature of the expressive disturbances in patients of the predominantly receptive group 215
3. Other characteristics of patients of the predominantly receptive group 221
4. A predominantly receptive disorder with typical changes in expression: Case No. 31 222
5. A predominantly receptive disorder with marked difficulty in reading and typical expressive changes: Case No. 22 236
6. A complex disorder with limitations in receptive processes and particular disturbances in repeating and writing to dictation: Case No. 28 263
7. Summary 272

X. Types of Aphasia: The Expressive-Receptive 275
1. The nature of the expressive-receptive disorders 275
2. A severe and extensive disorder: Case No. 37 281
3. A severe disorder in which all language performances are extremely limited, but many non-language performances satisfactory: Case No. 15 285
4. A disorder in which language performances are limited and non-language performances high: Case No. 27 290
5. Summary 297

XI. Types of Aphasia: The Amnesic 299
1. The nature of the amnesic disorder 299
2. Case No. 7 302
3. Summary 316

XII. The Cases of Brain Tumor 317
1. The nature and location of the lesions 317

2. Psychological characteristics 319
3. Summary 321

XIII. THE CONTROL GROUP OF PATIENTS WITH RIGHT-SIDED LESIONS AND NO APHASIA 322
1. The nature of the group 322
2. Test levels in relation to the normal 323
3. Correlational findings 332
4. Analyses of errors, difficulty value of test items, speed in work, and memory span 333
5. Summary 336

XIV. APRAXIA AND AGNOSIA 338
1. The case material 338
2. A case showing aphasia, apraxia, and agnosia: A.G. 344
3. Discussion of the concepts of apraxia and agnosia 359
4. Summary 364

XV. THE COURSE OF APHASIC DISORDERS 365
1. Survey of the material 365
2. Conditions of approximate stability 367
3. Improvement 377
4. Deterioration 381
5. Summary 383

XVI. REEDUCATION IN APHASIA 385
1. Training methods 385
2. Case No. 24 392
3. Results of training 407
4. Summary 412

XVII. THE PSYCHOLOGICAL CHANGES IN APHASIA 413
1. Variations in performance 413
2. Relative success on language and non-language tests 418
3. Behavior of clear-cut cases of aphasia in the practical situations of everyday life; social responses and attitudes 426
4. The nature of the aphasic disorders 429
5. Major conditions underlying the extent and nature of the aphasic disorders 435
6. Summary 441

XVIII. LOCALIZATION 444
1. General remarks 444
2. Localization from the study of cases in this research 447
3. Cerebral dominance and restitution of function 451
4. Summary 453

XIX. CONCEPTS OF APHASIA, APRAXIA, AND AGNOSIA: A COMPARISON WITH CURRENT VIEWS 455
1. The study of aphasia 455
2. The nature of aphasia 458
3. The classification of aphasic disorders 462
4. Apraxia and agnosia 466
5. Localization of lesions in aphasia 467

XX. CONCLUSION 471

APPENDIX I. CASE REPORTS 475
1. Expressive disorders 475
2. Receptive disorders 513
3. Expressive-receptive disorders 546
4. Amnesic disorders 556

APPENDIX II. TESTS 567
1. The principal tests of the battery 567
2. Supplementary tests 594
3. Shorter batteries 600

BIBLIOGRAPHY 603

INDEX 625

TABLES

I. Earlier classifications of aphasic disorders 54
II. Analysis of the total group of patients studied 121
III. Comparative data on the aphasic and control groups studied 125
IV. Data on the sixty patients of the aphasic group 126–129
V. Outline of the principal tests 135–136
VI. Records of first oral reading tests: Case No. 4 176
VII. Progress in writing sentences containing given words: Case No. 4 180–181
VIII. Improvement in language performances: Case No. 6 190–193
IX. Progress in oral reading: Case No. 16 202
X. Dictation and spelling records: Case No. 16 204
XI. Percentages of letter errors of different types: Case No. 22 .. 245
XII. Scores on Gray Oral Reading Tests: Case No. 22 249
XIII. Scores on successive tests: Case No. 7 306
XIV. Analysis of the fifteen cases of brain tumor 318
XV. Significance of the differences between median scores for the group of cases of right-sided lesions 330
XVI. Distribution of thirty-six cases of aphasia by the course of the disorder 366
XVII. Course of the disorder in thirty-six cases 368–375
XVIII. Relation between psychological improvement and regression of neurological symptoms in eighteen cases 378
XIX. Relation of handedness to location of brain lesion in ninety-eight cases 452
XX. Scores on Gray Oral Reading Tests: Case No. 10 479
XXI. Improvement in speaking, naming, and repeating: Case No. 51 508–509
XXII. Progress in oral reading: Case No. 35 532
XXIII. Progress in spontaneous writing: Case No. 35 534
XXIV. Medians and quartiles of scores for the group of normal subjects 577–578

FIGURES

Figure 1. Successive performance levels: Case No. 4, expressive 162

Figure 2. Drawing of a man: Case No. 4 174

Figure 3. Completion of the drawing of a hand: Case No. 4 174

Figure 4. Drawing of a chair from a model: Case No. 4 175

Figure 5. Performance in reporting newspaper articles: Case No. 4 179

Figure 6. Performance levels: Case No. 50, expressive 184

Figure 7. Successive performance levels: Case No. 16, expressive 197

Figure 8. Sample of spontaneous writing: Case No. 16 206

Figure 9. Drawings of a chair from a model: Case No. 16 207

Figure 10. Successive performance levels: Case No. 22, receptive 239

Figure 11. Performance levels: Case No. 28, receptive 265

Figure 12. Performances of 12 expressive-receptive patients in relation to the performances of the normal group 280

Figure 13. Successive performance levels: Case No. 15, expressive-receptive 286

Figure 14. Performance levels: Case No. 27, expressive-receptive 292

Figure 15. Relation of the median performance level of the group of 22 cases of right-sided cerebral lesion without aphasia to that of the total normal group 324

Figure 16. Age, sex, and race distributions for 22 cases of right-sided lesion without aphasia and for the matched normal group ... 325

Figure 17. Relation of the median performance level of the group of 22 cases of right-sided cerebral lesion without aphasia to that of the matched normal group 328

Figure 18. Attempts to copy figures made of small sticks: Case A.G. 354

Figure 19. Attempt to trace the Porteus Maze, Year IV: Case A.G. 358

Figure 20. Examples of poor drawings of a man made by adults of the normal group 359

Figure 21. Successive performance levels: Case No. 24, expressive 394

Figure 22. Three drawings of a man: Case No. 24 403
Figure 23. Performance levels (representative): Case No. 58, receptive .. 419
Figure 24. Performance levels (representative): Case No. 19, expressive-receptive 420
Figure 25. Performance levels (representative): Case No. 31, receptive .. 421
Figure 26. Drawings of a man: Case No. 60 542
Figure 27. Drawing of a house: Case No. 60 543
Figure 28. Sample items from Gates Word, Phrase, and Sentence Reading Test, Form 1 575

I

INTRODUCTION

THERE is no more difficult subject in the realm of neurology than aphasia. Few of the problems it involves have reached a satisfactory solution. Take the question of localization, for example. One may say that, inasmuch as aphasia itself cannot be accurately defined, no anatomical or physiological substratum can be given it. And yet the problem cannot be dismissed so easily, for there is plenty of reliable evidence to show that disturbances of speech appear with destructive lesions of the brain. The localization of the lesion, however, is, as the old master Hughlings Jackson put it, an entirely different matter from the localization of speech. To the followers of Jackson's doctrine, to which we adhere, the aphasic symptoms are the result of the activity of the uninjured parts of the brain, for dead tissues cannot produce kinetic phenomena. Yet even on this point there is no unanimity of opinion. Proponents of exact localization, by the marshalling of clinical and pathological evidence, believe it possible not only to determine the site of the lesion but also to make strict differentiations of the areas underlying various language functions.

One of the immense handicaps in the study of aphasia is the weight of the influence of ancient or traditional beliefs. To most neurologists the assertion that language disturbances are incapable of division into motor or sensory aphasia and that such terms as "agraphia," "alexia," and "word-deafness" are convenient names which have crept into the literature but cannot be demonstrated as "pure" disorders, brings about an antagonistic reaction, for even neurologists and psychiatrists dislike having their time-honored conceptions uprooted, with the additional prospect of having to learn new test methods for newer classifications. It is necessary only to recall the shelving of Hughlings Jackson's psychological views for a period of over fifty years and the acceptance of Broca's more easily grasped teaching.

Until recently most writers on the subject have been interested in the establishment of areas of the brain, lesions of which either produce definite types of aphasia or control certain activities relative to speech. Enough will be said to show that the test methods of the older investigators do not bear close investigation. And the same thing can be said of many of the moderns. Yet it has been on such grounds that clinical types of aphasia have been established. Indeed, as in many subjects, various types of disorder have been predicted on purely theoretical grounds; given certain premises on cerebral localization it is easy to describe hypothetical syndromes, and such types have crept into the literature, never either proved or disproved, but accepted by subsequent writers as definite facts.

It is to Henry Head's credit that he was the first to direct general attention to the development of test methods exclusively for aphasia. We have made less use of his tests than of the more recent developments in psychological test methods, but we freely admit that the latter are not infallible and that future work may upset many of our conclusions.

To add to the confusion on the question of localization the anatomical studies often leave a great deal to be desired. In many instances they have been incomplete. As a rule where adequate test methods have been employed, the pathological examination has been insufficient or vice versa. It is obviously necessary for students to adopt as nearly as possible uniform test methods with complete and uniform pathological studies. Otherwise there will be no more progress than there has been in the last half-century.

In this research a large amount of time, particularly in the first year, was devoted to a survey of the literature, the results of which are to be found in Chapters II, III, and IV. While the first part, which deals with what can be described as the old writers, is largely repetition, the second and third parts are a careful critical analysis of the modern literature, admittedly somewhat prejudiced, for we studied aphasia largely from the psychological point of view. Even in the first part, there is a new approach if not new material, especially in the discussion of Hughlings Jackson, where our estimate differs somewhat from that given by Head in his admirable discussion.

As a result of this survey it became obvious that *what was needed most was a study of the actual nature of the psychological changes occurring in aphasic conditions.* There were four chief objectives:

1. The establishment of a battery of tests satisfactory for the discrimination and analysis of aphasic disorders.
2. The study of the psychological changes in aphasia.
3. The classification of types of aphasia.
4. The study of the nature and location of the lesions present in aphasia.

It was thoroughly clear from existing work that aphasic changes were extremely complex and that they included not only the speech defects which were obvious to the early investigators but disturbances in complex thought processes. The extent and variety of the phenomena necessitated the selection of a large battery of tests, and also the addition of new tests as unusual cases called for special studies. The principal psychological tests are outlined in Chapter VI, and discussed in greater detail in Appendix II. In this appendix short batteries of tests are recommended for use in the determination of the type, the extent, and the severity of the aphasic disorder. These are satisfactory for ordinary diagnostic purposes. A word of caution, however, must be added in regard to the use of a simplified battery of tests if reeducation is contemplated or if a research study is to be made. The greater the simplification, the less complete is the knowledge of the aphasic changes; and the examiner who wishes to make a thorough study will do well to analyze a large number of performances by a greater variety of the tests cited and may often need to devise other tests to meet the specific requirements of the case.

A problem immediately arose in connection with the interpretation of the test results. The matter was easily handled when the aphasic disturbances were marked; when the patient, for example, could not articulate a word or gave wrong names for the familiar objects of his everyday life; but it became increasingly more difficult with the slighter disturbances. Then the patient showed errors and limitations which were not unlike those characteristic of the normal person of certain levels of education and intelligence. In the many performances where such errors appeared, the question became: What is the normal performance? And for the majority of tests, no answer to this question was available from previous work. In order to interpret the results for the aphasic patients, therefore, it was necessary to extend the research and include a control group of normal adults. The selection of these so-called normals was arranged to make the group as closely comparable to the aphasic group as possible. Educational and occupational data show that the normal group is not only similar to the aphasic, but that it represents a good sample of the population at large.

The plan throughout has been to interpret the aphasic performances in terms of the normal, placing the former in relation to the latter quantitatively and comparing the two from the point of view of method and quality. It goes without saying that the comparison cannot be drawn between the aphasic patient and any individual normal person. Each aphasic is judged on the basis of the median of the normal group for the particular performance, and of the normal variability characteristic in that performance. With an aphasic who is markedly superior or inferior in education or ability, allowance must naturally be made for the fact that he was decidedly above or below the normal median before the onset of the disorder.

The use of the normal group as a scale against which the aphasic is judged makes it possible to estimate the extent and the nature of the psychological changes consequent on the aphasia. The norms for the control group of normal adults are given in Appendix II so that the investigator who wishes to use the tests may estimate the relative position of his patient.

In studying the nature of the aphasic disorder another comparison is important and has been provided for in this research, namely, the comparison between the aphasic patient and the patients with a unilateral cerebral lesion without aphasia. Detailed studies of these patients with unilateral lesions but no aphasia have brought results of such great interest for a knowledge of cerebral organization that we have thought it worth while to continue them; first, to secure a larger and more representative group than that which had been studied when the results of the preliminary research were analyzed, and second, to make new studies of those cases whose types of performance differed most from the normal.

The question of classification of aphasic disorders is considered in Chapter VII where four empirical groups are outlined: the expressive, the receptive, the expressive-receptive, and the amnesic. In the four following chapters each of these types of disorder is discussed and illustrative cases are given. Additional cases are to be found in Appendix I. A great effort has been made to present as much material as possible in a form which other investigators may use as a basis for independent judgment. To make the records comprehensible to the reader who is not familiar with psychological tests and methods, however, a compromise has always had to be made between the presentation of raw data and their interpretation in general terms.

The nature and location of the lesions in the cases of aphasia studied are discussed in Chapters XII and XVIII. Pathological studies along these lines must be continued for while there is sufficient material already at hand to indicate that the recent trend against strict localization is justified, as yet very few necropsies have been obtained.

As in all research, the work which brought the specific objectives closer to achievement also led to further problems demanding still more study. One of these has already been noted: the psychological characteristics of cases of unilateral cerebral lesion without aphasia. Another is the problem of apraxic and agnosic disorders. This is discussed in Chapter XIV, with notes on the comparatively few cases in the group under observation which were of interest in this connection. Consideration is also given to the nature and limits of the disorders, with a view particularly to further studies.

That larger problems of great theoretical interest constantly arise in connection with work on aphasia need hardly be noted. It is a most fruitful field on the one hand for the study of the functional relations between different parts of the brain, and the significance of the study here has been increased by examinations of the non-aphasic cases with unilateral cerebral lesions. On the other hand, the pathological conditions of aphasia lead directly to an analysis of mental organization and have much to contribute to an understanding of the relation of language and thought.

II

THE HISTORY OF APHASIA: A CRITICAL SURVEY OF EARLY WORK

1. Trends in research
2. Early work
    - Broca: 1861
    - Bastian: 1869
    - Wernicke: 1874
    - Jackson: 1864–1893
    - Marie: 1906
    - American Investigators: Mills and Meyer

1. TRENDS IN RESEARCH

APHASIA has always been a subject of great controversy. From the early part of the nineteenth century when the first cases were described, many years before the term "aphasia" was introduced, loss of speech with right hemiplegia aroused great interest because of its significance for cerebral localization. The cases which were gradually collected gave some evidences of a cerebral localization of speech functions, but exceptions appeared almost as soon as a theory was proposed. The complexity of the problems, the doubts which new and unusual cases were constantly causing, and the frequent disputes have resulted in a very extensive literature which is not easily surveyed. Close study reveals that tremendous progress has been made. Sometimes the advance has been in more exact pathological studies, which have become increasingly more satisfactory with the development of histological techniques and the greater knowledge of anatomical structure; sometimes in the more careful determination of clinical findings and closer analysis of the nature of the speech disturbances. With successive investigators concentrating on the first or on the second of these two methods of attack, there have been two main tendencies in aphasia research, the anatomical and the psychological. These have never been and are not now distinct. Whichever approach interests the investigator more, he must take account of the other.

The anatomical approach was most prominent in the early days, when the problems of cerebral localization, in spite of the fact that they were only just beginning to be formulated, were already giving rise to heated controversies. Gall described two cases as early as 1819, and attempted to localize speech functions in the anterior parts of the brain. Shortly afterward, Bouillard, too, selected the anterior lobes as the cerebral organ responsible for language without, however, agreeing with Gall about the mechanisms of language.[1] About the same time Flourens was upholding a different hypothesis and emphasizing the unified functioning of the cerebral lobes. His contentions were supported by some experimental material, but the trend of belief was toward cerebral localization. Knowledge of cerebral organization was so limited and existing theories so diverse, that each new indication of a relation between a specific area of the brain and some physical or mental function was seized upon with avidity. The decade from 1861 to 1871 was particularly exciting for supporters of cerebral localization: they were first aroused by Broca's cases of loss of speech as a result of cerebral destruction which he demonstrated at necropsy, and later were given proof of localization by the work of Fritsch and Hitzig on the electrical stimulation of the cortex.

Even in this early period there were many investigators who were unwilling to accept doctrines of localization in the strict sense, and were made cautious by the negative cases which soon began to accumulate, where lesions found at necropsy were not in areas which should have been affected if the existing hypotheses of speech centers were valid. General interest, however, remained in the problem of the cerebral localization of aphasia rather than in that of the complex clinical manifestations of the disorder. Hughlings Jackson, who always turned his attention first to the speech disturbances and other changes in behavior, therefore stands out all the more sharply against the other investigators of the day. His initial contribution was made in 1864, the year in which the term "aphasia" was first used by Trousseau and only three years after Broca described his original cases of loss of speech through lesion of the brain. Thus through Jackson, the psychological, or better the functional, approach was developed almost as soon as the problem of aphasia came to the fore.

At the present time there are strong supporters of both the structural and dynamic schools, but the majority of recent investigators have joined the second group and regard aphasia as a functional problem which can be solved only by the most detailed analysis of all the changes in language and behavior. The increasing prominence of the dynamic view, which originated in such remarkably advanced form with Jackson, has not been the result of any one man's labor. It has come about through the work of many investigators, notably Pick, Goldstein, and Head, and it has run parallel to the development of psychological thought toward the dynamic point of view.

---

[1] H. Head, *Aphasia and Kindred Disorders of Speech*, I, 1926, 9–17.

To understand the progress which has been made in the study of aphasia and the problems which are now most crucial, it is fortunately no longer necessary to go back to all the original papers. There have been occasional surveys and in 1926 Head presented an excellent account of the early history of the subject. The first fifty years may therefore be discussed briefly, with summaries of the work of those investigators whose influence has been greatest. The large amount of later work requires detailed analysis. Here the contributions of any one man are less significant than the problems now occupying the center of the field, and in the next two chapters the recent literature will be discussed under the headings of these major problems.

2. EARLY WORK

Broca: 1861[2]

A firm adherent to the doctrines of cerebral localization, Broca believed that the cases he reported in 1861 were clear proof that certain speech disorders were associated with lesions in specific areas of the brain. While earlier investigators had generally been content to assign the function of speech to the frontal lobes, Broca went further and defined a particular part, the third frontal convolution, as the center for "articulated language." In 1861 he reported his first case, designating the disorders of articulated language as "aphemia" and outlining the destruction which he had found at necropsy.[3] A considerable portion of the left hemisphere was affected, with lesions involving the first temporal convolution, the small convolutions of the insula and the adjacent corpus striatum, the inferior portion of the ascending frontal gyrus, and the posterior half of the second and third frontal. The softening extended even to the first frontal and second temporal convolutions. Later in the same year Broca reported another case of loss of speech in which there was also a lesion in the left hemisphere. The third frontal convolution was destroyed in its posterior half and the second frontal much disturbed, while the first frontal was normal. Broca concluded that the aphemia in this case was the result of a circumscribed lesion in the posterior third of the second and third frontal convolutions.

---

[2] Following the name of each investigator is given the date or dates of his major contribution on aphasia.

[3] Head, *op. cit.*, 19–23.

His views aroused considerable opposition and a few cases were reported in which loss of speech occurred without lesion in the third frontal convolution. Broca was unable to explain these instances; he had found in 19 of his 20 cases that the lesion lay in the third frontal gyrus, and furthermore that the destruction in each case affected the left half of the brain. Although it had been suggested some years before, the importance of the left hemisphere for speech received general recognition only with this series of cases which Broca brought forward.

Broca's interpretation of the clinical findings was no less significant than his views on localization. He distinguished clearly between what he called *"aphémie"* and *"amnésie verbale."*

> The aphemic patient has a profoundly reduced vocabulary and may be speechless except for some monosyllables, oaths or words that do not seem to belong to any language. His ideas are intact, as shown by gestures, and he can understand what is said to him, and recognise words and phrases which he cannot pronounce or even repeat. On the other hand, the amnesic patient no longer recognises the conventional associations established between ideas and words. He can pronounce them, but they do not seem to have any bearing on the ideas he wishes to express; he is able to show by gestures that he has not lost all kinds of memory; it is the special memory, not only of spoken but of written words, that he has lost.[4]

Bastian: 1869

The development of the structural concept of aphasia was carried further by Bastian and his school. Bastian localized auditory and visual word centers and, in addition to these, tongue and hand centers which he termed glosso-kinesthetic and cheiro-kinesthetic. He believed that all aphasic speech disorders resulted from the destruction of the auditory or visual centers, or the fibers connecting these and the lower effector centers of the tongue, lips, or hand, and he was accustomed to show by diagram just where the lesion would have to be to cause given clinical symptoms. His method of examining an aphasic case was outlined to demonstrate the disturbances related to the particular centers he had defined.[5]

---

[4] *Ibid.*, 27.

Following the general distinction set up by Broca and others, Bastian divided language disturbances into two main groups, amnesia and aphasia. Patients suffering from amnesia showed a difficulty in recalling words and a serious disturbance in thinking, the latter resulting not from injury of a "conceptual" center, for Bastian did not go so far as to postulate this, but from the functional connections between the sensory centers which were disturbed and the higher centers. The aphasic patient, on the contrary, showed no disturbance in thinking but a great difficulty in expressing himself either by speech or writing. In the first disorder, the destruction was largely in the cortical gray matter; in the second, with the difficulty in speech and writing, it was to be found rather in the efferent fibers between the cortical gray matter and the corpus striatum or in the corpus striatum itself.

The fallacy of this school of investigators lay, as Head has pointed out, in the fact that they "believed that they could interpret the clinical manifestations directly in terms of anatomical paths and centers." They made little attempt to study the dynamic factors of language.

Wernicke: 1874

This static point of view was carried still further by Wernicke, whose influence has remained powerful to the present day. He was another of those whom Head called "diagram makers." He assigned the auditory center to the first temporal convolution and the conceptual basis of articulated speech to Broca's area.[6] Destruction of the first temporal gyrus abolished sound images and resulted therefore in lack of understanding of spoken words. Speech was free and plentiful, but characterized by errors which Wernicke thought to depend on the temporal lobe defect and the loss of normal auditory control. Furthermore, there were defects in writing and in reading. This syndrome was the famous sensory aphasia, which was soon equally well known as "Wernicke's aphasia."

Broca's aphasia, which resulted from a lesion in the center for articulated speech, was the disorder described by Broca and already generally recognized under his name. In accordance with his concept of cerebral organization, Wernicke later differentiated two further types of disorder: conduction aphasia, resulting from a break in the paths between the auditory center and the center for articulated speech; and total aphasia, a severe disorder which occurred when both centers were destroyed.

---

[5] H. C. Bastian, *Aphasia and Other Speech Defects*, 1898.

[6] Head, *op. cit.*, 62–63.

Hughlings Jackson: 1864–1893

Three years after Broca described his first cases of aphemia, Hughlings Jackson lectured at the London Hospital on loss of speech which accompanies right hemiplegia or follows epileptiform convulsions.[7] For the next thirty years he continued his precise clinical observations, and on the basis of these built up his theories of language and of nervous and mental functioning. Until Arnold Pick recognized their value and in 1913 dedicated *Die agrammatischen Störungen* to Jackson, his papers received very little attention. The neglect which they suffered resulted partly, as Head put it, from the fact that Jackson was "so anxious not to overstate his case that almost every page is peppered with explanatory phrases and footnotes," and partly from the very difficult problems which the work raised. Jackson's careful studies of behavior did not reveal a regularity in clinical findings and in the relation between these and the cerebral pathology which was in accord with the contemporary beliefs. The usual approach to the problems of aphasia in that day was structural, and Jackson's analysis required a dynamic conception of behavior. It is hardly enough to say that he was ahead of his time. Even now, fifty years later, with the far greater knowledge of cerebral functioning and of the abnormal changes in language and behavior, there still appears every year work which has not caught up to Jackson. A greater tribute to his advanced thinking, however, is the larger amount of important modern work which is still based on some of his principles and still inspired by his conception of cerebral and nervous functioning.

Jackson's differentiation of types of aphasia was approximately that of the other investigators of the day. He distinguished two main groups of patients: those who were speechless or whose speech was very much damaged, and those whose speech was plentiful but disturbed by many errors.[8] Among patients of the first group the understanding of spoken language was relatively satisfactory; among patients of the second group it was much disturbed. It is significant that Jackson described these two types without assigning them particular names: he was always intent on determining what the aphasic patient could do and he feared that names might hide the variations in response which careful observations showed. The first of the two groups interested him particularly, for these patients, who had lost their speech except for a few words or some jargon expression, furnished excellent material for study of the "activity of nervous arrangements which have escaped injury." The realization that "destructive lesions never cause positive effects, but induce a negative condition which permits positive symptoms to appear" was one of Jackson's most significant contributions, and was nowhere better exemplified than in the phenomena of aphasia.

---

[7] *Ibid.*, 30.

[8] Head, *Hughlings Jackson on Aphasia and Kindred Affections of Speech,* Brain, 1915, 38, 8–9.

Close observation of patients under all sorts of conditions showed Jackson that their responses could not always be predicted. In certain situations the speechless man surprised those who observed him by uttering some word or even a complete sentence. Jackson's insight enabled him to define the conditions under which this unexpected response occurred almost as they would be defined today. He found that the speechless patient often produced some word or phrase under the influence of emotional excitement or in a situation which called for a highly automatic speech response. On closer study he differentiated "recurring utterances" and "occasional utterances" and outlined them as follows:

1. *Recurring utterances:* jargon; and good words or phrases without propositional value. It was particularly common to find patients who could utter practically no words but "yes" or "no"; some could produce "yes" or "no" only as emotional responses, as interjections, while others could also use these words propositionally in reply to questions.
2. *Occasional utterances:* phrases or swearing which the patient could produce when he was excited but could not repeat at will; and real, but inferior speech responses which arise more or less automatically in some particular situation, as does the phrase "good-bye" when someone is leaving; and finally very rare phrases which were real speech.[9]

The words and phrases which the patient could not utter voluntarily or repeat, but did produce under certain situations were decisive evidence that there had been no such absolute loss of words or word-images as many investigators at the time supposed. While no one could prove that the patient retained "organizations for any other words than those he actually utters," the many examples of varied and appropriate responses which he did produce only as emotional or automatic speech showed that words were not lost but were simply not available for the higher service of propositional expression.[10] Jackson illustrated his point by the example of a woman who one day cried "Fire!" when a fire occurred in the street, and he then asked: "Is it not a grotesque supposition that this woman retained only the word 'fire'?"

---

[9] J. H. Jackson, *Selected Writings of,* II, 172–182.

The appearance of emotional or automatic speech responses, which Jackson called "inferior" speech, when voluntary or "superior" forms of speech were absent, led him to important conclusions on the nature of speech.[11] In opposition to Bastian and various other students of the day, he held that speaking or writing did not occur in words but in words referring to one another in a particular manner, and thus forming a "proposition."

> To speak is not simply to utter words, it is to propositionise. A proposition is such a relation of words that it makes one new meaning; not by a mere addition of what we call the separate meanings of the several words; the terms in a proposition are modified by each other. Single words are meaningless, and so is any unrelated succession of words. The unit of speech is a proposition. A single word is, or is in effect, a proposition, if other words in relation are implied. . . . It is from the use of a word that we judge of its propositional value. The words "yes" and "no" are propositions, but only when used for assent and dissent. . . . On the other hand, elaborate oaths, in spite of their propositional structure, are not propositions, for they have not, either in the mind of the utterer or in that of the person to whom they are uttered, any meaning at all; they may be called "dead propositions." . . .
>
> Loss of speech is therefore the loss of power to propositionise. It is not only loss of power to propositionise aloud (to talk), but to propositionise either internally or externally, and it may exist when the patient remains able to utter some few words.[12]

Jackson's understanding of the psychology of speech and of the nature of aphasia was an integral part of his theory of nervous functioning as a whole. The main points of this theory have been of great influence, particularly in Head's work. In Jackson's opinion, the evolution and dissolution of the nervous system showed a hierarchy of functional levels, with successively higher levels developing later, and breaking down sooner in the course of dissolution. He believed that destruction of functions at a more highly organized level removed inhibition over lower centers and these became "more easily dischargeable, or popularly speaking 'more excitable.' "[13] The breakdown of a higher center with the continued activity of a lower seemed to Jackson clear in the phenomena of aphasia, where propositional speech showed the most severe disturbance and the lower forms of automatic or emotional speech were often retained.

---

[10] Jackson was never misled into thinking of speech or memory as faculties, and he made it very clear that, whether for words or other images, "there is no faculty of memory apart from things being remembered." *Ibid.*, 166.

[11] "Speech" was for Jackson a broad term, used only occasionally in a narrower sense than "language."

[12] *Ibid.*, 159–160.

Jackson believed that the automatic speech processes extended far beyond the few utterances which the patient could produce under certain conditions, but could not produce voluntarily. They were to be found in the preliminary stages of speech before any verbal formulation had developed and in the understanding of spoken language.

Up to this point in the discussion the problems considered have been those of speech expression. These were the problems which Jackson thought most fruitful, and with these he scored his greatest success. His theories on the understanding of spoken language are less in accord with modern concepts. They are based on relatively incomplete studies of receptive difficulties in aphasia; Jackson did not concentrate on patients whose speech was full of errors and whose understanding was poor, but made his deductions on the basis of those who were speechless or nearly so, but still able to understand pretty well. The fact that aphasics of this second type could produce a few words under certain conditions and could understand what was said showed that they were not "wordless." While they had lost the higher service of speech, the power of forming propositions, they retained lower and more automatic forms of speech and could "receive propositions." The inability to speak or write propositionally usually came with lesion of the left side of the brain, while lesion of the right side alone caused no such disturbance. Jackson therefore assumed that the more automatic speech processes, including both the inferior types of speech response and the understanding of speech, were more equally and fully represented in each half of the brain than were the higher forms of speech.

---

[13] *Ibid.*, 192.

> The division . . . was not that the left half of the brain serves in speech, and the right in receiving speech and in other ways, but that "nervous arrangements for words used in speech *lie chiefly* in the left half of the brain," and "that the nervous arrangements for words used in understanding speech (and in other ways) lie in the right also."[14]

Analysis of the meaning of "and in other ways" leads into the most difficult part of Jackson's theory of language. Not only did the nervous arrangements in the right half of the brain make possible the receiving of propositions when the left half was injured, but "every proposition in health occurring during activity of the left side of the brain is preceded by a revival of the words of it during activity of the right half."[15]

It was on this basis that Jackson explained some of the peculiar "recurring utterances." There was a woman, for example, who was taken ill while riding a donkey and whose utterance was, "Gee, Gee," and there was a clerk paralyzed after working hard on a catalogue, who said only, "List complete." It seemed illogical to Jackson that these phrases, which were produced easily and clearly when all other speech responses were much damaged, should result from functioning of the injured left hemisphere. He therefore took them to represent the preliminary revival of words which was just occurring on the right side at the time of the injury, and which would have involved the left side immediately if the injury had not prevented.[16]

Definition of the processes which precede verbal expression is always difficult, and Jackson's statements were somewhat contradictory, often because he did not specify exactly what he meant by the term "image." Evidently, however, he believed that thinking, particularly in the early stages of the process from thought to speech, could take place in "visual and tactile images" and "faint actions"; these he called "symbols but little symbolic." Coining the term "verbalising" to cover "the whole process of which speech is only the end or second half," he then differentiated between the subject- and the object-proposition.[17]

---

[14] *Ibid.,* 182–183.

[15] *Ibid.,* 186.

[16] In some cases the recurring utterances were jargon, and Jackson then made the guess that they were transpositions or elisions of syllables of some of the words which were being revived in the right at the time of the injury.

In typical cases, recurring utterances appear whenever the patient tries to speak. Their frequency seemed to Jackson to fit in well with his concept of dissolution of the nervous system. The damage to the left hemisphere, by destroying the more highly organized function, released the lower functional activity of the right side which was then manifested to a greater degree. The more sudden was the removal of control, in his opinion, the more excitable the nervous arrangements of the right hemisphere.

The object-proposition is easily recognized; it is the verbal formulation, whether it represents internal or external speech.[18] The limits of the subject-proposition are more difficult to determine. It seems to follow on the simple revival of images and to require their revival in some relation; in other words, it represents formulated thought, but not complete verbal formulation. Undoubtedly some but not all of the images revived are verbal, and their revival in relation is "at once the end of the subjective and the beginning of the objective stage of verbalising." The preliminary revival of images Jackson thought to take place through activity in the right hemisphere, the "stronger voluntary reproduction on the left." Thus not only the receiving of propositions when the patient heard what was said to him, but the development of the subject-proposition depended to large extent on the nervous arrangements of the right hemisphere.

The important role which Jackson postulated for the right hemisphere was in part the result of his firm conviction that the "faculty" of language could not be localized anywhere in the left hemisphere, "or anywhere except in the whole brain or whole body." In this statement he anticipated a point of view which has now become prominent. There can be no doubt, however, that his concept of the functioning of the right hemisphere was influenced by the fact that neither he nor other investigators at the time had been able to study enough cases to find the change in the clinical picture with lesions in different areas of the left hemisphere. Until a large number of cases of different types were studied both psychologically and anatomically, many of the chief problems of localization were even more completely matters of speculation than they are today. In view of the limited material at hand, it is therefore particularly remarkable that Jackson's views on localization should contain many of the points which are considered of major significance at the present time. His most important beliefs with regard to localization may be summarized by the following statements:

---

[17] *Ibid.*, 187. Jackson here quoted Herbert Spencer and followed closely in his division of the psychological proposition into two, that which concerns the subject and that which concerns the object. Jackson wrote:

"The subject-proposition symbolises an internal relation of two images, internal in the sense that each of them is related to all other images already organised in us, and thus it symbolises states of *us;* the object-proposition symbolises relation of these two images as for things in the environment, each of which images is related to all other images then organising from the environment; thus it stands for states of the environment."

[18] Jackson's distinction between "internal" and "external" speech was the very simple one of non-articulated and articulated speaking. "Anatomically and physiologically regarded, we may say that the *same* nervous processes are concerned in internal as in external speech. The difference is that the excitation of these nervous processes in speaking to one's self is so slight that the nerve currents developed do not spread to the articulatory and vocal muscles; in speaking aloud the excitation is strong, and currents do reach these muscles." *Ibid.*, 131.

> Whilst I believe that the hinder part of the left third frontal convolution is the part most often damaged, I do not localise speech in any such small part of the brain. To locate the damage which destroys speech and to locate speech are two different things. The damage is, in my experience, always in the region of the corpus striatum. . . . It is admitted that there are exceptional cases: loss of speech has occurred from damage to the region mentioned on the right, and the region on the left has been damaged without any affection of speech. *But the matter of most significance is that damage to but one hemisphere will make a man speechless.*[19]

> . . . the nearer the disease is to the corpus striatum, the more likely is the defect of articulation to be the striking thing, and the farther off, the more likely is it to be one of mistakes of words.[20]

That part of Jackson's theory discussed above revolves altogether around the speech disorders of aphasia and their basis. His full clinical observation carried him beyond the field of language, however, and gave him several important indications that aphasia, while primarily an "affection of speech," was, "at least in many cases, more than a loss of speech." He found sometimes that pantomime was disturbed, patients could neither express their meaning verbally nor by descriptive gestures. Furthermore, he discovered patients who were not only unable to speak voluntarily, but also unable to perform simple voluntary actions which did not involve speech. The classical example is the patient who could not put out his tongue at command or by imitation, and who could still put it out to lick a crumb from his lips. Such cases were extremely significant from two points of view: they furnished additional evidence of the ease of the performance of the involuntary act over the voluntary; and they showed that disorders outside of the field of language existed in addition to, if not as a part of aphasia. In some few cases of aphasia Jackson also found marked disturbances in images, which were apparently not confined to word-images. He encountered patients, for example, who could not find the way around from one familiar place to another. Just how far these defects are a part of the aphasic disorder is, of course, a matter of definition; Jackson distinguished between the disturbances of speech and the disturbances of recognition, classifying the latter under the term "imperception." Thus he very early recognized in the patients who could not carry through voluntary actions some of the phenomena later called "apraxia," and in the patients who failed to recognize familiar objects or places, phenomena later called "agnosia."

---

[19] *Ibid.*, 129–130.

[20] *Ibid.*, 127.

There remains to be discussed one further point of Jackson's theory, the relation between the speech affections in question and intelligence. The problem has always been a crucial one and Jackson dealt with it very ably. From his observation of patients who were speechless but still capable of automatic speech processes, he concluded that the intellectual deficit in these cases was by no means so great as the loss of language expression would indicate.

> . . . the speechless man has thought so far as reviving images go. He has words which can be automatically revived so as to place images of objects in order. Although he has but one side for verbalising—the automatic side—he has . . . *two* sides for the revival of images, and thus he can still think, can still have certain relations of likeness and unlikeness. No doubt he is lame in his thinking. He will be unable to learn novel and complex things, for he will be unable to keep before himself the results of complex arrangements of images. . . . He can bring two images into co-existence—existence in one unit of time—but cannot, without speech, organise the connection, if it be one of difficulty.[21]

The speechless man's perception is usually unaffected, so that he can revive images which serve as "symbols in mentation." If, however, perception is affected as well as speech, then the disorder is far more serious.

> Suppose, however, "imperception" is added to the defect of speech, the formation of images, arbitrary symbols and those unconscious processes which precede their development will be disturbed. The "general intelligence" will then appear to suffer greatly.[22]

---

[21] *Ibid.*, 141–142.

[22] Head, *op. cit.*, 23.

A final quotation will show how clearly Jackson recognized the impossibility of limiting the disorder as one of speech or of intelligence, and the variations from case to case in the extent of the disorder and its manifestations.

> It is, in some classes of cases of disease of the nervous system, hard to say where obviously motor symptoms end and where the purely mental ones begin. Thus there is (in cases of hemiplegia on the right side) every gradation betwixt, on the one hand, a total loss of power to express ideas, or a loss of knowledge of the relation of words to things, and, on the other, apparently scarcely more than an ataxy of articulation. And sometimes in the same case we find that the patient makes mistakes in words, and also articulates badly.[23]

Since Pick's work and Head's, Jackson has received the recognition which he so long deserved. He is generally credited as being the first to realize the value of the psychological study of aphasia and the primary importance of the exact clinical findings. His penetrating analysis of behavior which led to the differentiation of higher forms of response and lower, emotional, or automatic forms has been carried on by the most important modern investigators. When acclaim is so general, it is important to recognize the limitations in Jackson's work, for without such recognition, there can be no just evaluation of the men who followed him, building upon his work but contributing much of their own. The fairly comprehensive survey just made of his contributions on the subject of aphasia will show how many of his ideas have become foundation stones in modern theories, and how many have been scrapped. Among the former are to be found his emphasis on aphasia as a psychological problem, his attack through the clinical findings rather than the pathological destruction, his concept of higher and of lower, more automatic forms of response, his appreciation of the complex relations of language and thinking, his discovery of related disorders later called apraxia and agnosia, and some of his important views on localization. That part of his work which is no longer significant includes his differentiation of types of disorder, much of his theory of pre-verbal formulation, his opinions on the role of the right hemisphere in speech, and his observational methods as opposed to the test methods now in use. That the work which has proved of lasting importance should so far outweigh the part which has been discarded is the final demonstration of Jackson's advanced thinking.

---

[23] Jackson, *op. cit.,* 125.

Marie: 1906

Jackson brought out revolutionary papers on aphasia for thirty years without stirring the medical world very greatly. Marie's first 1906 paper caused an immediate uproar. At least one reason for the very different reception accorded Jackson's work and Marie's is not far to seek. In the former the controversial questions were the complex problems of language and mental functioning; in the latter, the specific problems of localization about which everyone had some opinion, justified or not.

While the chief interest in Marie's work originated in his new doctrines of localization, and to a large extent remained there, these were by no means his only contributions. He attacked the clinical manifestations of the disorder with an unprejudiced mind, and recognized clearly that the last word on aphasia had not been said when the defects were described as the result of loss of auditory images, of visual images, and so forth. He asked for a more complete clinical analysis of the disorders, with a view to the more exact determinations of their nature and extent. In 1908 Moutier outlined the rather extensive battery of tests which Marie and his followers had been using with aphasic patients.[24] The tests covered many processes of speaking, reading, and writing; drawing; mimicry; memory; and performances taken to indicate intelligence. While they did not represent the earliest battery of tests for aphasia, they were a great advance over the methods of study commonly used at the time.

Marie was perhaps less wholly given over to the empirical method than Jackson, but his theory of aphasia and his classification of disorders were definitely based on his clinical findings. He took a new position on types of aphasia, saying that defects in articulation should not be included under the term "aphasia" but were better designated as "anarthria." The old Broca's aphasia Marie thought a combination of anarthria and the true aphasia or Wernicke's aphasia. There were then three groups in his classification: anarthria, Broca's or motor aphasia, and Wernicke's or sensory aphasia.

In Marie's opinion, the true aphasia was invariably distinguished by the presence of a general intellectual defect and a special defect of language. Critics immediately pointed to the great difference which existed between an amentia or dementia and the particular deterioration which constituted the aphasia. Marie agreed with them and emphasized the special defect in language which he had postulated, but he reaffirmed the existence of a general intellectual defect.

---

[24] F. Moutier, *L'Aphasie de Broca,* 1908, 375–383.

In the typical Broca aphasic he found that there was always extreme difficulty in speaking. Sometimes the patient could produce only a few words. Sometimes his speech was more extensive but still very defective because of word changes, elisions, paraphasic errors, and structural abbreviations constituting the "telegram style." The defects in articulation arose from the anarthric component of the disorder, a particular incoordination of the muscles in the voluntary emission of sounds. The verbal and structural changes arose from the disturbances of inner speech which characterized the "true" or Wernicke aphasia. Errors of this second group appeared in writing as well as in speaking for they were disorders of language and all its "modes of exteriorization." Reading and arithmetic were also seriously affected, and there were signs of intellectual defect in the diminished comprehension of spoken language, poor memory, impoverished imagination, defective mimicry, and so forth.

Some of the clinical findings which led Marie to his position on the special language defect and the further defect of general intelligence were those which have always made careful investigators unwilling to say that aphasia was altogether a disorder of language. Jackson had noted that pantomime, as distinguished from emotional expression by gesture, was disturbed in some cases. Marie observed this fact too, but he also singled out other changes which he took to be signs that general intelligence was affected. In expounding Marie's point of view, Moutier wrote:

> *L'aphasie est déjà un trouble intellectuel spécial, mais à côté de ce trouble particulier, il existe des troubles de l'intelligence générale, parfois difficiles à mettre en évidence, mais que l'on peut toujours retrouver. Ce sont des défauts de la mimique, de l'attention, de la mémoire, de l'association des idées, ce sont des oublis professionnels enfin.*[25]

The indices of intellectual defect he noted included performances which depended on language as well as those which did not. In view of the special and marked defects of language, it would actually have been difficult to say how far the changes in performances requiring language resulted from the language disorder and how far from the defect in general intelligence. The problem could not be studied so well at the time of Marie's early work as it can now, because techniques of estimating intelligence had then only begun to develop and there were very few tests for intelligence apart from language expression. Marie was on firm ground, however, in stating that defects of mimicry and many of the losses of professional skills were signs of intellectual disturbance which could not be attributed to the special language disorder. He cited, for example, the case of a patient who had been a cook and who after a cerebral attack with aphasia could no longer cook.

---

[25] *Ibid.*, 202.

Marie's concept of the nature of aphasia and his clinical divisions aroused great controversy. Dejerine, whose theory rested on the idea of language images, protested that motor aphasia had nothing to do with Wernicke's aphasia, that intellectual weakening was not always a characteristic of the aphasic disorder, and that anarthria was a paralysis. On the whole, however, it was Marie's views on localization which were most hotly contested. His first 1906 paper was a denial that the left third frontal convolution had any special role in the function of language. This was his most startling assertion, but actually he differed from the current doctrines on many points.

He had been led to reject the left third frontal convolution as the crucial area for "articulate language" through a reexamination of the brains of Broca's first two cases and through his own study of the many patients at Bicêtre. He found in one of the cases described by Broca that the lesion extended far beyond the limits of the left third frontal gyrus, destroying the lower half of the precentral gyrus, the greater part of the first temporal, and much of the supramarginal gyrus.[26] The destruction thus extended into the so-called Wernicke zone just as Marie thought it should when the aphasia was of the Broca type, that is, anarthria plus Wernicke's aphasia. In the second brain there was no definitely localized lesion, but the base of the second frontal convolution was much decreased in size. There was no evidence, then, that the left third frontal gyrus was an area of any particular significance.

The doctrines on localization which Marie substituted for the classical ones were in brief as follows: "true" aphasia resulted from lesion in an extended Wernicke area, which included the posterior part of the upper temporal gyri and the supramarginal and angular gyri; anarthria came with subcortical lesions of what he called the "lenticular zone" in either hemisphere (area of the insula, claustrum, external and internal capsules, and caudate and lenticular nuclei); and Broca's aphasia with lesion of this lenticular zone and of Wernicke's area or the tracts to or from it. Furthermore, Marie denied that there were separate centers, within the Wernicke area or anywhere else, for auditory or visual speech.

---

[26] Head, *Aphasia and Kindred Disorders of Speech,* I, 69.

These views were strongly contested by Dejerine, Madame Dejerine, and others, but the controversy became less excited with time and Marie did not publish any other papers so startling as that on the role of the left third frontal convolution. In 1917, however, with Foix, he brought out a new statement of his theory on the basis of the war material. Here he seemed to be less interested in exact study of the clinical findings than he had been in the days when he made his first brilliant attack on the aphasia problem. In 1917 he wrote that, given a knowledge of the precise anatomical injuries, he could predict the aphasic disorder, except in the case of temporal lesions or of very extensive lesions.[27] He differentiated two chief zones:

1. Zone of anarthria: an anterior zone, corresponding to the inferior part of the ascending frontal and the neighboring parts of the second and third frontal convolutions, and extending in to the Island and the lenticular nucleus.
2. Zone of the "true" aphasia, which always involved some general decrease in intelligence: a posterior zone in which three secondary areas could be distinguished.
   a. Temporal zone: the "true" aphasia in its purest form, with good articulation but great difficulty in understanding, naming, reading, and writing.
   b. Angular zone: severe alexia with moderate disturbances in other language functions.
   c. Supramarginal zone: "global" aphasia affecting all elements of the function of language.

It was not the belief of Marie and Foix that these syndromes were the only types of aphasia, but simply that they were the types which appeared with the circumscribed cortical lesions characteristic of the war injuries. In essentials, Marie believed that the findings in these traumatic cases supported his earlier clinical and anatomical views on aphasia and he made no important changes in his theoretical position. The chief interest in the new work lay in the definition of peculiar characteristics of the traumatic in-

[27] P. Marie and C. Foix, *Les Aphasies de guerre,* Rev. Neur., 1917, 31, 57.

juries and particularly in the observations on the course of the different disorders.

American Investigators: Mills and Meyer

MILLS

Charles K. Mills began to contribute papers on aphasia in the early days when the structuralists were in full swing. In England, Bastian and Broadbent were analyzing cases from the point of view of diagrammatic arrangements of speech centers, and exerting far more influence than Jackson. On the continent, Wernicke had recently published *Der aphasische Symptomenkomplex* with its description of Broca's aphasia from a lesion in the third frontal convolution, the center of images of movement for articulate speech, and sensory aphasia from a lesion in the first temporal, the center of sound images. Mills' own interests were in accord with those predominant at the time. A firm believer in cerebral localization, he contended that close attention to facts obtained through clinicopathological observation showed extreme differentiation of the brain into "functional areas, sub-areas and centers." In lectures and papers appearing in the last twenty years of the nineteenth century and on into the twentieth, he defined the centers for speech and related functions. In a paper published in 1904 he summarized his views on the cerebral speech zone and its divisions.[28] He differentiated a motor center in the hinder portion of the third frontal convolution and extending to the insula; an auditory speech center in the first and second temporal gyri; visual centers in the angular gyrus; and two further centers in which he firmly believed, a graphic in the caudal half or third of the second frontal and a naming center in the third temporal. The nature of his conception is apparent from the following extract from the paper:

> In the cerebral cortex are situated primary . . . centres for all the forms of sensibility, special and more general. . . . Each of these centres has surrounding it what may be termed its sphere of influence, this in the case of the auditory centre being a large area concerned with all forms of what in a broad sense might be termed object-hearing. Within this general region of special sounds-recognition are probably located a separate centre for natural sounds, like the notes of birds, another for musical notes, and still another for word-hearing. The centre of primary recognition is probably located . . . in the caudal portion of

---

[28] C. K. Mills, *Aphasia and the Cerebral Zone of Speech,* Amer. J. Med. Sci., 1904, 128, 375–393.

the first temporal gyre and in the retroinsular gyres. The word-hearing centre is on the outskirts of this region, at about the junction of the first and second temporal convolutions.[29]

When Marie denied the existence of auditory, visual, or motor speech centers, Mills immediately took up the fight. With Dr. William G. Spiller he made a study of lesions of the lenticular zone with results which were not in themselves strong evidence against Marie's position.[30] At the joint meeting of the New York and Philadelphia Neurological Societies in 1906, Mills led the discussion on aphasia, allying himself with Dejerine and against Marie.[31] The discussion makes interesting reading today for it shows how Marie's revolutionary ideas had stirred even the most ardent upholders of classical doctrines of aphasia. Mills himself gave no quarter on the question of centers for motor, auditory, or visual images. He considered the intellectual defect described by Marie "conditioned by destruction and disturbance of the sensorial cerebral centers, and of the structures connecting these with other parts of the brain," but he recognized that the importance of the intellectual defect had often been underestimated by students of aphasia. Furthermore, in connection with the slight difficulty in understanding shown by motor aphasics, he made the following statement:

> In a correct sense the cerebral zone of speech is a single great mechanism, but it has many parts. If the machinery in one part is interfered with, the effects of such interference may extend to all parts.[32]

In the discussion Lloyd found much to be said for Marie's simplification of the aphasia theory, explaining that bedside observations had never shown him the many varieties of aphasia which had been outlined and diagrammed, twenty-eight by actual count in a contemporary paper. Dercum said that his own clinical studies supported many of Marie's views, and found the presence of an intellectual defect in aphasia beyond question. The discussion made it clear that while structuralists might continue to assign speech functions to specific areas of the brain, they would not again hold sway uncontested.

---

[29] *Ibid.*, 388.

[30] C. K. Mills and W. G. Spiller, *The Symptomatology of Lesions of the Lenticular Zone with some Discussion of the Pathology of Aphasia,* J. Nerv. & Ment. Dis., 1907, 34, 558–588; 625–650.

[31] *Discussion on Aphasia, especially with Reference to the Views of Marie, ibid.*, 459–473.

[32] *Ibid.*, 465.

Mills' own work on aphasia extended beyond the structural analyses of the problem. He was interested in its practical aspects and contributed papers on aphasia as a medico-legal question and on the treatment of aphasia by training. He was not unaware of the more philosophical aspects, but like most of his contemporaries he overlooked them in favor of the fascinating analysis of cerebral localization.

MEYER

Adolf Meyer, beginning work on aphasia considerably later than Mills, had a different point of view. His clinical experience showed him many cases which could not be fitted into the classical divisions of aphasia. In his Harvey Lecture in 1910 he warned against slavish adherence to the diagrammatic conception of aphasia.

> The great risk of didactic schemes is excessive condensation and excessive desires for one-word designations for really compound disorders. Size up and detail the mechanisms which enter into the picture, call the spade a spade, the functional disorder a functional disorder, and the lesion a lesion, but do not try and mix it all into one confusing word. The only real and lasting solution comes from the utilization of adequately defined anatomical and functional mechanisms.[33]

Recognizing that aphasia was a functional problem which could be attacked only through detailed analysis of the patient's responses, Meyer devised a rather extensive test schema, similar in many points to that developed by Marie about the same time.[34] He emphasized the importance of a knowledge of the patient's educational level, a complete neurological examination, and accurate tests of hearing, vision, and other senses. When these basic facts had been determined, he then studied spontaneous speech, "series speech," repetition; reaction to words and sounds, to things seen, smelled, tasted, and felt; reading, writing, drawing, music; gestures and various performances which might be disturbed in apraxia; and internal language, as manifested in performances depending on memory, attention, and general intelligence.

On the basis of a "symptomatic grouping of results" from these tests, he differentiated receptive disorders, intrinsic disorders, and disorders of emissive functions. The first group included receptive disorders in both auditory and visual fields, either type possible in pure form or complicated by disturbances of speech. Meyer was particularly interested in the so-called word-deafness and the disturbances of speech which he usually found to accompany it and which were those he called "elaboration disorders."[35] These consisted largely of paraphasia, difficulties in evoking words, and disturbances in reading and writing. When the patient showed a real word-deafness, Meyer found a defect in the entrance zone of the auditory receiving station or its marrow, whereas in "elaboration" aphasia without word-deafness the receiving zone appeared to be free, at least on its mesial side.

---

[33] A. Meyer, *The Present Status of Aphasia and Apraxia,* Harvey Lectures, 1910, 5, 247.

[34] Meyer, *Examination for an Aphasic Patient,* copy on file in the Phipps Clinic, Johns Hopkins.

The second group of disorders, the intrinsic, were the elaboration disorders, which sometimes appeared alone, i.e., apart from "extrinsic" receptive or emissive defects.

Disorders of emissive functions were of two types: the difficulties of execution only, or the "pure motor" aphasia without agraphia; and the more complicated difficulties of sentence-planning, word-planning, and word-execution in speech and writing.

Meyer's work represented an advance over most of the views current at the time, and is really a transition step between the older doctrines of localization of speech functions and the more recent studies of aphasia as complex and particular changes in mental functioning. He broke away from anatomical or physiological terms in his classification, insisting that the anatomical and the functional should be kept separate. His distinction between "pure" disorders of receptive or emissive functions and "elaboration" disorders such as paraphasia, difficulty in word-finding, and so forth, is not unlike the distinction Goldstein has drawn. At the same time it is evident that Meyer was less interested in the more complex manifestations of aphasia and their interrelationships than are many of the recent investigators. He was greatly interested, however, in the sensory functions and their relation to the "pure" receptive disorders, and advanced important views on the subject of the agnosias.

---

[35] Meyer, *The Relation of the Auditory Center to Aphasia,* J. f. Psychol. u. Neur., 1908, 13, 212.

III

THE HISTORY OF APHASIA: A CRITICAL SURVEY OF MODERN WORK

1. The Structural Approach
    - Henschen
    - Kleist
2. The Nature of Aphasia
    - Aphasia as a disorder of symbolic formulation and expression
    - The apraxic theory of aphasia
    - Aphasia as a disorder of a basic mental function
    - Hypotheses, other than Head's, emphasizing the specific language deficit in aphasia
3. Types of Aphasia
    - The four forms of disorder outlined by Head
    - Current views on types of aphasia
        - Motor aphasia
        - Sensory aphasia
        - Amnesic aphasia

I. THE STRUCTURAL APPROACH

WHILE interest in aphasia as a problem of cerebral localization is by no means so prominent as it was thirty or even twenty years ago, a number of workers are still primarily concerned with the determination of the lesions leading to particular clinical findings. Many investigators, notably Henschen, Mingazzini, Bianchi, and Bonvicini, do not believe it possible to build an adequate theory of aphasia on the basis of clinical study, and take issue with Head for his attempt to do so.[1]

Within the structural camp there are divergent opinions about the problems of cerebral localization as they concern aphasia. There is still no universal acceptance of the principle which Jackson expressed in 1874: "To locate the damage which destroys speech and to locate speech are two different things." Extreme localizationists such as Henschen think it possible to assign particular speech functions to definite areas of the brain. Others of the investigators whose approach is primarily structural do not believe a strict localization of mental processes possible, and attribute the disturbance in a mental function to a particular lesion without concluding that the function therefore takes place only in the area of the lesion.[2]

---

[1] G. Bonvicini, *Die Störungen der Lautsprache bei Temporallappenläsionen,* Handb. der Neur. des Ohres, 1929, 1642.

Within recent years there have been a host of contributors on the subject of the localization of the lesions in aphasia, notably Pick, Goldstein, Isserlin, Pötzl, Klein, Von Monakow, Bonhoeffer, Von Mayendorf, Bonvicini, Henschen, Kleist, and Foix. Many of these men, however, have attacked the problem from the dynamic rather than the structural point of view; their work will be discussed in the sections on the nature and types of aphasia. The characteristics of the structural approach are most clearly apparent in the work of such men as Henschen and Kleist, and the positions these two investigators have taken will therefore be outlined briefly.

Henschen

Of all modern investigators, Henschen is the most extreme protagonist of the doctrine that knowledge of aphasia is possible only through knowledge of localization. Starting with the demonstration that specific lesions in the area striata produced specific defects in the visual field, he took up the study of aphasia as a defect in more complex and highly organized mechanisms than vision, but one which would admit of the same type of analysis into distinct partial functions which could be attributed to specific brain areas. For the purpose of this analysis he undertook the tremendous task of tabulating all the cases in the literature for which anywhere nearly sufficient anatomical and clinical data had been presented.[3] This work is a source-book of primary importance for aphasia material, but it does not allow for the finer clinical analysis which modern work emphasizes and which is of course impossible without comprehensive reports of the disturbances in their functional relationships.

From this material Henschen concludes that it was possible to determine a strict localization of speech and related functions.

---

[2] Niessl von Mayendorf, *Ueber neuere und neueste Errungenschaften der Aphasieforschung,* Zsch. f. d. ges. Neur. u. Psychiat., 1927, 110, 195.

[3] S. E. Henschen, *Klinische und anatomische Beiträge zur Pathologie des Gehirns,* V–VII, 1920–1922.

His most important views may be outlined as follows:

1. A lesion in the left third frontal convolution results in motor aphasia, or, in the term Henschen prefers, "aphemia." The essential disturbance here is the patient's inability to produce word-forms. Cases of lesion of the left third frontal in right-handed persons have been reported without speech disturbance, and Von Monakow has explained the preservation of speech by the activity of the cortex in the immediate vicinity of the third frontal, "the extended Broca area." Henschen does not agree and supposes rather, since speech disappears completely and permanently with bilateral destruction of the third frontal, that the right acts as a substitute for the left.[4] He states, however, that he has always found some speech defect with lesion of the left third frontal convolution in a right-handed patient.

2. When in addition to the left third frontal convolution, the neighboring parts of the precentral gyrus are affected, the patient will show dysarthria as well as aphemia.

3. The transverse gyrus is the hearing center; the first temporal convolution the center for the hearing and understanding of speech. With bilateral destruction of the first temporal, there is permanent word-deafness; with destruction only on the left in the right handed there may be partial recovery through the activity of the right.

4. Lesion of the angular gyrus produces a second form of sensory aphasia, word-blindness. The right angular gyrus, which may take over some of the function of the left, is a very imperfect substitute.

5. Destruction in different occipital areas may lead to different forms of word-blindness, associated with some defects in writing and marked defects in copying.

6. Lesions of the occipital lobe or the angular gyrus producing word-blindness, or temporal lesions producing word-deafness, or parietal lesions producing apraxia may all cause agraphia, but there is another form of agraphia which results from destruction of a specific graphic center at the foot of the second frontal convolution. This rarely occurs alone but is usually accompanied by aphasia resulting from a lesion in the neighboring third frontal. Henschen does not believe that substitution by the right second frontal when the left is injured is either proved or probable.

7. In Henschen's opinion a center for calculation is more difficult to localize from the available cases but undoubtedly exists and is probably to be found in the occipital lobe. With a lesion on the left, he considers it possible for the right to take over some of the simpler processes in calculation.

8. The left third frontal convolution in front of Broca's area is the important

---

[4] Henschen, *On the Function of the Right Hemisphere of the Brain in Relation to the Left in Speech, Music, and Calculation*, Brain, 1926, 49, 111.

region for singing, but the right third frontal may suffice if the left is injured. The left temporal pole is probably the important area for the hearing and comprehension of music, but activity on the right can often compensate for destruction on the left.

In view of his belief that every psychological activity, even logical thought, could be localized, Henschen naturally objects to "vague psychological constructions" as a basis for discussing aphasia, and finds no merit in the psychological analyses of Goldstein, Head, and others.[5]

Kleist

The present status of aphasia considered as a problem of cerebral localization is most clearly shown in Kleist's recent work, *Gehirnpathologie.*[6] The findings for about 280 of the cases which Kleist saw during and after the War are presented and the significance of these for the problems of cerebral localization is considered in the light of the War cases published by other authors and the important cases from civil practice. More than 70 original cases are reported in the sections on apraxia, agnosia, amusia, and aphasia. The scope of the work is larger than that of any other contribution on these disorders in recent years. The work as a whole, however, suffers first, because the examinations as reported, while sufficient from the point of view of the clinical and pathological findings, are by no means sufficient to show the actual characteristics of the complex changes in language and behavior; and second, because the nature of the pathology in these traumatic cases is not such as to justify exact delimitation of the lesions, or the fine analysis of the relation between these and the neurological and psychological disturbances. The extreme differentiation of types of disorder and the rigid definition of the lesions underlying them are outstanding characteristics of the book.

From the point of view of aphasia, types of disorder are outlined according to an analysis of the elements from which speech reception and expression are built up. The sensory disorders Kleist differentiates as: 1) word-sound-deafness; 2) word-deafness; 3) name-deafness, or deafness for word meanings; and 4) sentence-deafness. The motor disorders, arrived at by a corresponding analysis, are sound-, word-, name-, and sentence-muteness.

---

[5] Henschen, *Aphasiesysteme,* Msch. f. Psychiat. u. Neur., 1927, 65, 87–137.

[6] K. Kleist, *Gehirnpathologie,* 1934.

A summary of Kleist's position from the point of view of the receptive disorders may be stated briefly as follows:

1. *Word-sound-deafness* is a perceptive rather than a "memory" disorder and as such resembles color-blindness in the visual sphere. It corresponds to the classical concept of pure word- or speech-deafness, with the characteristic features of intact spontaneous speech, naming, and writing.[7] The patient fails to appreciate speech sounds, is unable to repeat them, and naturally has difficulty understanding words. The latter is not primary, however, and in certain forms of incomplete speech-sound-deafness, comparable to the usual concept of conduction aphasia, the patient understands words better than he grasps the word-sounds.[8] Kleist believes that word-sound-deafness may depend either on subcortical lesions of the temporal lobe, as in the usual theory of pure or subcortical sensory asphasia, or on cortical lesions. The site of the lesion in either case is the transverse convolution, and the area on the left is better developed in most men than the area on the right. If the lesion is cortical it spreads to the first temporal convolution and so results in slight word-deafness as well as word-sound-deafness.
2. *Word-deafness,* corresponding to Wernicke's or cortical sensory aphasia, is considered by Kleist to be a disorder in the time sequence of the separate parts of the word. The effects of this disorder appear not only in understanding and repeating but also in spontaneous speech. Kleist agrees with Wernicke that in speaking the acoustic word-traces control the motor speech process.[9] As to the locale of word-deafness, Kleist defines the posterior part of the first temporal convolution, the part neighboring the transverse convolution (posterior part of Brodmann's Field 22). The left hemisphere is most important for word-deafness but in Kleist's opinion the War material seems to indicate a greater importance of the right than was formerly assigned to it.
3. *Name-deafness* is a disorder in understanding words as names, not because of a break, as Wernicke thought, between the word and the concept, but because of a disturbed psychological process, the naming function.[10] For this reason Kleist prefers the term name-deafness to word-meaning-deafness or transcortical sensory aphasia. The disturbances in understanding are accompanied by confusions in the use of words or by failures to bring out the words at all. The "brain apparatus" serving the "naming function" lies in the posterior part of the second and third temporal convolutions (Brodmann's Field 37).
4. *Sentence-deafness* is a disturbance in understanding sentences which is ac-

---

[7] The patient may make some errors in speaking but they are errors in single sounds, which are, in Kleist's opinion, to be differentiated from the errors in sound-sequences constituting the usual paraphasia and characterizing word-deafness or Wernicke's sensory aphasia.

[8] For conduction aphasia, see pages 76–78.

[9] For Wernicke's theory, see pages 10–11; for the discussion of complex sensory aphasia, pages 70–78.

[10] When this name-deafness is just developing or has improved considerably, Kleist thinks it the same as amnesic aphasia. See pages 78–82.

companied by important changes in expression designated by Kleist as paragrammatism. In contrast to the abbreviated form of expression constituting agrammatism and appearing with motor aphasia, this second form of disturbance is characterized by confusions in the use and order of words and grammatical forms. Kleist finds this disturbance with temporal lobe lesions and locates sentence-deafness, with the particular confusions in expression which accompany it, in the posterior part of the first temporal convolution.

The four forms of motor disorder and their anatomical bases are defined as follows:

1. *Speech-sound-muteness,* or aphasic anarthria, is a disorder of the phonetic unities of speech, which Kleist considers an innervatory apraxia of speech-sound formation. He believes that the anatomical substrate of sound praxia is in the foot of the left anterior central convolution (Brodmann's Field 6). A subcortical form can appear with a break in the projection and corpus callosal fibers from the left lower anterior central convolution.

2. *Word-muteness,* like word-deafness, is a disorder affecting sound sequences. Kleist rarely found a complete muteness in the War cases, but severe cases could produce only a few short words or syllables. Longer words are broken up or shortened and thus show different types of errors from the confusion in sound sequences characteristic of the sensory paraphasia. Speaking is slower than in the sensory cases. The origin of the disorder is that determined by Broca, a lesion in the foot of the third frontal convolution, on the left in the case of a right-handed patient. In Kleist's opinion a lesion in this region will not produce disturbances in writing, and if these exist they depend on separate lesions in areas crucial for alexia or agraphia.

3. *Name-muteness* is a disorder which does not affect the formation of sounds or words, but a higher level of speech, the production of words as names. Kleist finds that a patient of this type not only can repeat words, but can use them in series speech and affective expressions and he can read aloud. His essential difficulty is in producing the words, not in "finding" them; the latter is the characteristic of the temporal name-amnesia. The locale of name-muteness is thought to be more anterior than the crucial areas for sound- or word-muteness and to lie in the *pars ascendens* of the opercular portion of the left third frontal convolution. If the disorder is marked or permanent, the underlying tissue is seriously involved.

4. *Sentence-muteness* is the motor counterpart of sentence-deafness and shows agrammatism rather than paragrammatism. The patient can say words and names but he cannot express himself, at least not completely. He omits many connecting words. Kleist assigns the lesion in sentence-muteness to an area between that for word- and name-muteness. He finds more instances of sentence-muteness and also of name-muteness in the cases resulting from War wounds than in the ordinary cases of cerebral lesion.

2. THE NATURE OF APHASIA[11]

Aphasia is a disorder manifested chiefly in language processes. Thus far agreement is fairly general, but beyond this preliminary statement there are great differences of opinion. The first important difference arose when Jackson rejected the current hypothesis of aphasia as a loss of "memory images" and explained the disorder as one of "propositional" expression. The second arose when Marie again rejected the "memory image" hypothesis and proposed that aphasia was actually a defect in general intelligence together with a defect in special language intelligence. In spite of frequent attacks, the "memory image" hypothesis has persisted to the present day. It is no longer accepted by those whose approach is functional but it is still the convenient psychological framework for the structuralists who think in terms of motor, auditory, or visual centers.

Apart from this original hypothesis, however, there are today a number of divergent concepts of the very varied phenomena of aphasia. Among these, four are sufficiently different to warrant particular discussion: Head's concept of aphasia as a disorder of symbolic formulation and expression; the so-called apraxic theory of aphasia arising from Liepmann's work on apraxia; the theory of aphasia as a disorder of a basic mental function, the nature of which is expressed by different authors as the capacity to effect normal "figure-ground" formations or spatial and temporal constructions; and finally the hypotheses of those who do not believe that aphasia represents a change in a basic mental function but emphasize the part of the language deficit.[12]

[11] The nature and the types of aphasia discussed in this and the following section have to do with aphasia as an organic disorder with a lesion in one or sometimes both of the cerebral hemispheres. Occasional cases of "hysterical aphasia" have been reported, where no organic basis was found but the language disturbances were similar to those of one of the types of disorder found with cerebral lesions. For such a case see Di Lalli (1930). The author discusses the criteria by which he thinks the hysterical case can be differentiated from the true aphasic.

[12] Luria has a very interesting point of view which differs to some extent from all of these (1932). As a result of his studies of affective disorganization, he finds that the changes in aphasia are not confined to speech processes, but show up in the motor responses of either hand during speech conflict. The aphasic disorder also appears in "the elaboration of intention"; the patient is helpless when he has to do something "necessitating an elaborated purpose, for example, the indefinite command 'to do something.' " This failure of intention leads Luria to consider aphasia as a disturbance of "will" as well as of "intellect." At the same time he emphasizes the important role of speech in organizing behavior and the extent of the damage which may occur as a result of speech disorder.

Aphasia as a Disorder of Symbolic Formulation and Expression

Head's theory of aphasia justly receives first place in the discussion because it is the modern form of one of the earliest explanations of aphasia, the disturbance in propositionizing which Jackson postulated in 1868. The terms "propositionizing" and "symbolic formulation and expression" are of like significance. Head made the change because he thought that "symbolic formulation and expression" was clearer and more nearly covered all performances which might be abnormal in cases of aphasia. Head wrote:

> I have combined under the general heading of "symbolic formulation and expression," the disorders of language produced by a unilateral lesion of the brain, because in the majority of instances the gravest disturbance is shown in the use of such symbols as words and figures.[13]
>
> . . . any act of mental expression, which demands symbolic formulation, tends to be defective and the higher its propositional value the greater difficulty will it present.[14]

The "greater difficulty" Head conceived as greater complexity and greater degree of abstraction. Either would result in more defective performances by aphasic patients.

Head believed that the complex processes of symbolic formulation and expression could be disturbed in a variety of ways which would be manifested clinically as different types of aphasic disorder.[15] The following passage gives the kernel of his theory.

> All these forms of psychical activity [included under the term symbolic formulation and expression] are rarely disturbed uniformly in any one instance and sometimes one set of tests, sometimes another, yields the more abnormal results. This leads clinically to the appearance of diverse "types" of aphasia, each of which represents some particular form of functional derangement.
>
> Disorders of language of this kind cannot be classified as isolated affections of speaking, reading and writing; for these acts are more or less disturbed whatever the primary nature of the defect. Nor can they be attributed directly to destruction of auditory or visual images or to any other analogous processes, which belong to a relatively low order in the psychical hierarchy. Each clinical variety represents some partial affection of symbolic formulation and expression; the form it assumes depends upon the particular modes of behaviour which are disturbed or remain intact.[16]

---

[13] *Aphasia and Kindred Disorders of Speech*, I, 210. [14] *Ibid.*, 212.

[15] For discussion of different types of disorder, see pages 47–82.

[16] *Op. cit.*, 218.

While Head thought that aphasia was essentially a disorder of symbolic formulation and expression, he found defects in performances which were not directly dependent on language symbols. Some of these defects he explained by supposing that the performance actually involved some "inner verbalisation" which the aphasic disorder prevented. He was not, however, willing to say that all the disturbances which appeared with aphasia resulted from language defects. He left this question open.

> By symbolic formulation and expression I understand a mode of behaviour, in which some verbal or other symbol plays a part between the initiation and execution of the act. This comprises many procedures, not usually included under the heading of the use of language, and the functions to be placed within this category must be determined empirically; no definition can be framed to cover all forms of action which may be disturbed at one time or another according to the nature and severity of the case. If clinical experience shows that some particular aspect of behaviour is affected in association with these speech defects, it must be included, although it is not logically implied, in the purely descriptive term "symbolic formulation and expression."[17]

As to the further significance of disorders of symbolic formulation and expression, Head pointed out that they resulted in specific changes in thought and behavior.

> All these processes which suffer in aphasia are essentially psychical and, in so far as they are defective, the capacity of the mind is restricted. Yet it is not "memory" and "general intelligence" which are primarily affected, but the mechanism by which certain aspects of mental activity are brought into play. In proportion as these forms of behaviour are necessary for the perfect exercise of psychical aptitudes, "general intelligence" undoubtedly suffers.[18]

With defects of symbolic formulation, the higher forms of thought are the most severely affected, and the patient is, in Head's opinion, forced back to simpler and more primitive thinking. His new methods of procedure are to be considered as responses "to some interference with the mechanism necessary for the perfect use of language," and are "governed by the conditions of the moment."[19] They are the "result of a fresh integration carried out by all available portions of the central nervous system."[20]

It was Head's opinion that students of aphasia had taken cognizance of the psychical manifestations of the disorder and of the anatomical destruction, but failed to pay sufficient attention to the physiological disturbance evoked by the lesion. He expressed this disturbance as a loss of "vigilance," or of the high-grade physiological efficiency underlying all types of activity from muscle tonus to the complex processes of speech.[21] As vigilance is lowered by any organic or functional condition, the most complex forms of behavior are the first to suffer. Head's discussions on this subject have not altered the concept of physiological function and its relation to psychical activity, but they are important because they stress the study of aphasia as a disorder of function.

---

[17] *Ibid.*, 211.

[18] *Ibid.*, 418.

[19] *Ibid.*, 424.

[20] *Ibid.*, 549.

The Apraxic Theory of Aphasia

When Liepmann analyzed his famous case of apraxia in 1900, he found speech disturbances in addition to the defects in automatic movements and purposive behavior.[22] He suggested that all the changes in speech and motor behavior could be included under the term "apraxia." In 1905 he again stated that apraxia could be called "aphasia of the extremities" or that expressive aphasia could be called "apraxia of the speech muscles."[23] He added that the disorders of receptive aphasia, namely word-deafness and word-blindness, could be designated as agnosic.

This theory of aphasia was based on a hypothesis of "loss of memory images." Apraxia was taken to indicate loss of kinetic memories or dissociation of these from other memories, and its appearance in limb movements or in speech movements depended on the type of memories affected. The intellectual disorder in aphasia which Marie postulated was in Liepmann's opinion not the cause but the effect of the aphasia, the effect, specifically, of the loss of memory images which were the necessary tools in thinking.[24]

In his later work Liepmann found that all aphasic manifestations could not be classified as forms of apraxia or agnosia, and differentiated between apraxia of the limbs or facial muscles and aphasia.[25] Since the author himself relinquished it, the apraxic theory of aphasia would not require further consideration were it not for the fact that it is still maintained by prominent investigators and is still the implicit basis for much of the modern work in classifying aphasic patients, relating their symptoms, and so forth. Arguments for and against the apraxic theory came to light most clearly in the discussion which followed Head's Hughlings Jackson Lecture in 1920. Head had described aphasia as a disorder of symbolic formulation and expression and he had explained the various forms of aphasia as different types of deterioration in the symbolic function which were not comprehensible as defects in the motor or sensory aspects of speech.

---

[21] *Ibid.*, 486–487.

[22] For discussion of apraxia, see pages 100–106, 108–116.

[23] H. Liepmann, *Drei Aufsätze aus dem Apraxiegebiet*, 1908, 19.

This was a very early use of the terms "expressive" and "receptive" to designate the two main types of aphasic disorder.

[24] *Ibid.*, 72.

[25] Head, *op. cit.*, 99–100.

Wilson believed that many of the symptoms Head had been describing were apraxic or agnosic in nature. He stated:

> I accept the general division of aphasia into receptive and executive defects; I hold that ordinary motor aphasia is but a part of motor apraxia, ordinarily called apraxia, and sensory aphasia of agnosia. The patient with auditory agnosia hears sounds, but does not recognize them, i.e., does not know their meaning. Among these sounds may be word-sounds, which he hears, but the content, the symbolic meaning, is for him unknown. The same is true of alexia as a variety of visual agnosia. Defects of this sort may certainly occur in unilateral lesions of the left hemisphere. On the executive side motor aphasia is a part of apraxia; the patient is not paralysed, but he cannot say what he wants to say, as the apraxic cannot do what he wants to do.[26]

These statements were altogether at variance with Head's point of view, for he did not admit pure cases of word-deafness, word-blindness, or motor aphasia, but believed that aphasia always involved complex language disorders which could not be expressed in terms of high-grade defects of perception or movement. Wilson's statements are not, however, so much at variance with the views of those investigators who believe that there are "pure" forms of aphasia, and who distinguish, for instance in writing, between the errors which show a complex language disturbance, and the errors which show a difficulty in letter forms. The problem will be taken up again in connection with the "pure" types of disorder discussed in the next section. For the question of the nature of aphasia, it need only be noted that errors which can be classified as agnosic or apraxic constitute only a small part of the aphasia phenomena, and that no theory of aphasia as an agnosic or an apraxic disorder will suffice to explain the variety of language disturbances which appear.

---

[26] S. A. K. Wilson in *Discussion on Aphasia,* Brain, 1920, 43, 438.

Aphasia as a Disorder of a Basic Mental Function

With the increasingly detailed analyses of aphasic disturbances, the changes in one type of performance have often been found to be essentially the same in nature as the changes in a different type. The similarity has seemed to call for the assumption of a fundamental disorder manifested in a variety of different performances. Head's study led him to conclude that the disorder was one of symbolic formulation and expression. His tests, however, were largely of symbolic processes or of processes which could be interpreted as symbolic. Different types of tests and different theoretical approaches have seemed to other investigators to show a change in thinking of a more fundamental order than that in the symbol function. Most of the theories of aphasia as a disorder of a fundamental function are now based upon the principles of *Gestalt* psychology, but some of them developed independently. The most prominent is that held by Goldstein, whose many contributions on the subject of aphasia over a period of thirty years have made him one of the leaders in the field. A second important concept of the nature of aphasia is that developed by Van Woerkom. His theory at first had quite a different slant from that of Goldstein's, but its final expression in his last paper was almost entirely in terms of *Gestalt* psychology. Other theories which differ to some extent from these have been stated by Bouman and Grünbaum (1925), Wolpert (1930), Lange (1930), Klein (1931), and Conrad (1932).

Goldstein's point of view is best expressed in *Die Lokalisation in der Grosshirnrinde* or in the shorter paper, *Ueber Aphasie.*[27] Very briefly it may be stated as follows: the various symptoms of aphasia are the manifestations of a single functional disorder, loss of the ability to grasp the essential nature of a process. This is equivalent to the *Gestaltstörung* or the inability to differentiate the "figure" and the "ground." Goldstein wrote:

> *Indem sich bestimmte Teile eines Reizkomplexes im Erlebnis zu einer Einheit, zu einer Ganzheit zusammenschliessen, treten sie gegenüber dem Erlebnis der übrigen gleichzeitigen Reizwirkungen als etwas Besonderes, als etwas Wesentliches hervor, als die allein Beachtung heischende "Figur" gegenüber dem mehr indifferenten "Hintergrund."* Dieses richtige Hervortreten des Wesentlichen *einer Situation, eines Vorganges gewissermassen als allein wichtige, be-*

---

[27] K. Goldstein, *Die Lokalisation in der Grosshirnrinde,* Handb. der norm. u. pathol. Physiol., 1927, 10, 600–836; *Ueber Aphasie,* Schweiz. Arch. f. Neur., 1926, 19, 3–38.

stimmende "Figur" gegenüber dem mehr indifferenten "Hintergrund" ist beeinträchtigt.[28]

Simpler figures may still be differentiated when the more complex cannot. This fact explains why a patient can still carry through some performances when he cannot carry through others and why he can still reach a successful solution by some methods when others are impossible for him. The "round-about" methods the patient may use when his normal behavior is disturbed necessitate the close qualitative study of performance which Goldstein has always demanded.[29]

Goldstein saw in the fundamental disorder of figure-ground formation the origin of disorders of special higher functions such as Head's symbolic formulation or the disturbance in "categorical behavior" which he himself with Gelb postulated as the basis of amnesic aphasia.[30] The patient who cannot act categorically cannot apprehend a given object as a member of a class, as one of a group of objects which have certain common properties. Failing in categorical behavior, he exhibits behavior of a more primitive perceptual type, the nature of which Goldstein has discussed at some length.

Goldstein does not believe the disorder in figure-ground formation dependent on the location of the lesion but on the destruction of a "cortical function." He does not deny that the different regions of the cortex differ in their importance for a *particular* function, or that the location of the lesion determines the specific way in which the disturbance of the *basic* function will be manifested. He states:

---

[28] Goldstein, *Die Lokalisation in der Grosshirnrinde,* Handb. der norm. u. pathol. Physiol., 1927, 10, 666. It is to be noted that in Goldstein's opinion the aphasic patient fails not because of destruction of memory images but because of inability to achieve the pattern into which they should fit.

[29] In Goldstein's opinion, the patient suffers not from a series of particular defects but from a change in the whole personality, or, more exactly stated, in the total organism. (See especially *Beobachtungen über die Veränderungen des Gesamtverhaltens bei Gehirnschädigung,* Msch. f. Psychiat. u. Neur., 1928, 68, 217–242.) In studying the total behavior of patients with brain injuries Goldstein has noted a number of abnormal tendencies: the tendency to rest and to overlook all stimuli which do not belong to the task; the tendency to keep things in order, and thus to maintain a definite point of view; the tendency to avoid empty space, manifested for example in small, crowded writing; and finally the inability to deal with meaningless material. Although the work of other investigators has shown that these tendencies are by no means universal, it is nevertheless most important that they should be recognized when they do appear. To Goldstein goes the credit for pointing them out, and for shifting the emphasis from the study of specific speech defects toward the study of all the changes in behavior and their interrelationships.

[30] Goldstein, *Die Lokalisation in der Grosshirnrinde,* Handb. der norm. u. pathol. Physiol., 1927, 10, 669. For discussion of amnesic aphasia, see pages 78–82.

> *Bei jeder Lage des Herdes wird die Grundfunktion des Gehirns beeinträchtigt, die wir als Figur-Hintergrundsbildung bezeichnen möchten. Jeder Herd führt zu einer Entdifferenzierung der Figur-Hintergrundsbildungen, die in ganz bestimmten Veränderungen der Leistungen in Erscheinung tritt. Die jeweilige Lage des Herdes führt dadurch zu einer differenten Symptomatologie, dass dadurch die verschiedenen Leistungen in verschieden starker Weise von diesem Entdifferenzierungsprozess betroffen werden. . . .*
>
> *Lokalisation eines Vorganges bedeutet für uns eine ganz bestimmte Erregungsverteilung innerhalb eines differenziert gebauten Nervensystems mit einer besonderen Gestaltung der Erregung an einer bestimmten Örtlichkeit ("Figur"). Eine bestimmte Örtlichkeit ist charakterisiert durch den Einfluss, den die besondere Struktur dieser Stelle auf den Gesamtvorgang ausübt durch das Moment, das ihre Erregung kraft der in ihr vorliegenden Struktur zu dem Gesamtgeschehen beiträgt.*[31]

These statements on localization are further qualified by a survey of the energy forces of the nervous system and of the organism as a whole.[32] Goldstein repeatedly emphasizes the fact that the entire organism is a unity of which the nervous system is an integral part. The sources of energy for the nervous system are the same as those for other activities. From an analysis of the symptoms he concludes that the available amount of energy is constant within certain limits, and consequently that if one performance requires a large amount, the rest of the system has less energy at its disposal. Assuming that the brain injury requires a greater expenditure of energy in a given functional activity, he explains many pathological phenomena as the result of the failure of one performance because of the greater energy requirements of another. For example, an aphasic patient who understands when he reads to himself may fail to understand when he has to read aloud because a large amount of energy has to go to the production of speech sounds. As to the distribution of energy in general, Goldstein concludes that the functions most necessary to the organism are maintained longest and most satisfactorily; that, when this first condition has been met, the oldest performances are maintained longest; and finally, that the goal is achieved in the shortest possible way and with the least possible consumption of energy.

---

[31] *Ibid.*, 673.

[32] *Ibid.*, 674–678.

It is undoubtedly true, as Head pointed out, that investigators have stressed the anatomical and the clinical aspects of the aphasia problem without sufficient analysis of the physiological changes. Head's concept of vigilance presents the general situation in an interesting way, but it does not actually lead to further understanding of the problem. Goldstein has attempted a more detailed analysis of the energy forces. His propositions are in part re-statements of generally admitted facts, for example, that the biologically more important functions are retained longest. He has been widely acclaimed for his recognition of the importance of "round-about" performances, and his description of these in terms of energy relationships as the result of the increased difficulty of the normal performance and the tendency of the organism to fall back on the next easiest way. His other concepts of the distribution of energy with regard to the disturbed performances and those which the patient can still achieve have been less generally accepted. There are many investigators who do not agree that the disturbed process makes a greater requirement from the point of view of energy and, as it were, drains energy from the rest of the system, thereby weakening other processes.

Although his work is not so extensive, Van Woerkom has, like Goldstein, made very detailed analyses of individual cases in an effort to determine all the changes in language and behavior.[33] When he found disturbances in performances not directly dependent upon language, Van Woerkom did not look for their origin in defective "inner verbalisation" as Head did, but in non-verbal thought. He attributed his different point of view to the fact that he had worked a great deal with children, and found that language processes were of later development than many non-language processes. In constructing his hypothesis, Van Woerkom falls back on an analysis of the stages between thought and verbal expression like that which Pick had outlined. He differentiates, first, the conception of the whole idea; second, a stage of analysis and synthesis in time and space; third, the sentence schema; and fourth, the choice of words and the final verbal expression.[34] In view of the defects he observes in non-verbal behavior, he looks for the essential disorder in the pre-verbal stage of analysis and synthesis in space and time, and constructed tests which would bring out defects

[33] W. van Woerkom, *La signification de certains éléments de l'intelligence dans la genèse des troubles aphasiques,* J. de psychol., 1921, 18, 730–751; *Sur l'état psychique des aphasiques,* Encéphale, 1923, 18, 286–304; *Ueber Störungen im Denken bei Aphasiepatienten,* Msch. f. Psychiat. u. Neur., 1925, 59, 256–322.

[34] It will be necessary here to summarize Pick's analysis of the thought-speech process. Starting from a study of the changes in grammatical and syntactical forms which are to be found in the speech and writing of many aphasic patients, he searched in philological and psychological work for hypotheses which would fit in with the pathological facts. His outline

in the manipulation of spatial and temporal relations. He found, for example, patients who could not join four pieces of paper to make a rectangle when a model was placed before them, nor find the way out of a maze, nor reproduce rhythms which had been tapped on the table. The spatial aspect of these disorders Van Woerkom defines as a "loss of geometric sense"; with such a loss the patient could recognize forms well even if they were complex, but he could not grasp the relation of their component parts. The temporal aspect is essentially a loss of any idea of succession of the elements within the complex.

These fundamental disorders in spatial and temporal differentiation sometimes had serious effects on language performances; in other words, they sometimes resulted in severe aphasia. In telling a story or constructing a sentence, the patients could not get the logical relationships necessary to order elementary facts in space and time. In writing, this constructive difficulty was likely to be even more apparent and, besides, the order of letters within the word was often confused. In reading the patients had difficulty analyzing the words phonetically and synthesizing the elementary sounds; they often lost their place and were unable to follow the sequence of the printed words. Counting was usually unimpaired, but calculation was exceedingly difficult because the patient could not manipulate number concepts.

In his last paper Van Woerkom put less emphasis on the disturbances in spatial and temporal constructions, and came closer to the more general concepts of the *Gestalt* School.[35] One case reported here showed an inability to construct a coherent whole from the separate parts. The patient had difficulty, for example, in putting a series of pictures into the correct sequence to tell a story; he gave his attention to the single parts and often the irrelevant parts, without anticipating a schema which would unite the pictures into a meaningful whole. He had difficulty in constructing sentences, either in spontaneous speaking or to include given test words. Similarly, he often failed to appreciate the meaning of a sentence as a whole. Furthermore, it is noteworthy in view of

---

of the processes from thought to speech was influenced by the point of view of the Würzburg School. He differentiated four stages:

1. Intuitive thought (comparable to Marbe's *Bewusstseinslage*)
2. Structural thought (comparable to Ach's *Bewusstheit*)
3. The sentence schema
4. The choice of words

It was obvious, as Pick pointed out, that these stages were not sharply differentiated: the intuitive thought had some degree of structure; and the structured thought was probably not completed before the sentence formulation began. Furthermore, the series did not always include all four stages, but appeared differently according to the nature of the situation, the purpose of the speech, and so forth. In many of the automatic speech responses of everyday life, there is apparently an immediate transfer from thought to complete verbal response. Even in the higher forms of propositional or representative speaking, there are often displacements within the process. (A. Pick, *Aphasie,* Handb. d. norm. u. pathol. Physiol., 1931, 15, II, 1436–1438.)

[35] Van Woerkom, *Psychopathologische Beobachtungen bei Stirnhirngeschädigten und bei Patienten mit Aphasien,* Msch. f. Psychiat. u. Neur., 1931, 80, 274–331.

Goldstein's insistence on the change in the total personality, that Van Woerkom here discerns an alteration in everyday behavior comparable to the changes shown in the test performances. The patient was euphoric and passive; he dealt with the parts of a task one by one without constructing a plan for the purposive solution of the whole.

Bouman and Grünbaum also found a fundamental change in thinking in their 1925 case, but not of the same nature as that which Goldstein first described as a difficulty in figure-ground formation.[36] In their opinion the patient could achieve only an "amorphous total impression"; he failed in every performance which required differentiation, and the greater the differentiation required the more seriously he failed. He could not, for example, pronounce words containing both "p" and "b," because he could not differentiate between these similar sounds. The use of this case as an example of a basic change in mental functioning from a circumscribed lesion has been criticized because, in an operation for tumor over the left sensory region, a circumscribed encephalitis was revealed. It has been pointed out, however, that the lesions might actually have been more extensive than the operation showed.

Wolpert, on the basis of a case of alexia with signs of intellectual disorder, supports Bouman and Grünbaum in the definition of the fundamental disorder as a weakness in differentiation.[37] His patient, too, may have had considerable cerebral disturbance for he had had three attacks before the examination. Wolpert differs from Bouman and Grünbaum in saying that the fundamental disorder was not in thought but in memory activity, a distinction which apparently emphasizes the disturbance of content as against the disturbance of function. Furthermore, Wolpert lays great stress on the location of the lesion as the most important factor in determining the manifestations of the disorder, while Bouman and Grünbaum tend to explain the greater changes in some performances than in others according to the nature of the performance.

The controversy as to the nature of the fundamental disorder has recently been carried on largely in connection with cases showing the so-called parietal syndrome. The aphasic changes in these cases vary, usually including amnesic aphasia or paraphasia and paragrammatism, and they are generally accompanied by disturbances in writing, calculating, spatial orientation and construction, and by Gerstmann's finger agnosia.[38] On the basis of a case of this type, with pronounced amnesic aphasia, Conrad has defined the essential disorder as a difficulty in understanding the structuration of the whole when the whole itself and its separate parts are understood.[39] In other words he traces the various separate disturbances to a disorder of the *Gestalt* function, as did Goldstein, but he further specifies that the particular nature of the disorder is a difficulty in appreciating the structuration of the whole. Other patients may show instead a difficulty in appreciating the whole as an entity, and Laubenthal in the following year reported a case showing both these types of disturbance in the *Gestalt* function.[40]

---

[36] L. Bouman and A. A. Grünbaum, *Experimentell-psychologische Untersuchungen zur Aphasie und Paraphasie,* Zsch. f. d. ges. Neur. u. Psychiat., 1925, 96, 481–538.

[37] I. Wolpert, *Ueber das Wesen der literalen Alexie,* Msch. f. Psychiat. u. Neur., 1930, 75, 207–266.

[38] For further discussion of Gerstmann's syndrome see footnote 62, pages 59–60.

[39] K. Conrad, *Versuch einer psychologischen Analyse des Parietalsyndroms,* Msch. f. Psychiat. u. Neur., 1932, 84, 28–97.

Other investigators who have studied similar cases depart further from the concept of a fundamental *Gestalt* disorder. Lange considers that there is not a "total" but a *Werkzeugstörung,* with the greatest changes in the most differentiated performances.[41] In the report of his 1930 case he defined the nature of the changes as a disturbance of the "category of direction in space." Klein has also presented a hypothesis of a limited as opposed to a total disorder, and all the performances involved are in his opinion related to the differentiation of the hand.

Satisfactory conclusions cannot yet be drawn as to the presence of disorders of basic mental functions in aphasia. Evaluation of the existing reports is difficult, first, because there are still too few cases where thorough and unprejudiced studies have been made and, second, because the tests used by different investigators have been so different as to preclude comparisons between cases. Furthermore, in many instances studies of non-language performances have not been adequate. While part of the disagreement in the definitions of the fundamental disorder results from diverse and incomplete test methods, there is already enough evidence to indicate that actual differences do occur in the exact nature of the disorder; and that there are also differences in the extent of the disorder, with changes which in some cases go far beyond the language processes and in others are apparently limited to language. The differences make it impossible to base any theory of aphasia on a single case or even on a small group of cases.

Hypotheses, Other than Head's, Emphasizing the Specific Language Deficit in Aphasia

The work on aphasia as a disorder of some basic mental function has been doubly valuable: it has furnished a working hypothesis which is satisfactory for many cases and it has stimulated new work among the opposition. The strongest point of the opposition is the conviction that aphasia is not a disorder of a basic mental function. No formal theory is offered in place of this, but the emphasis is placed on the fundamental importance of the language deficit in aphasia.[42] Foremost among the investigators who hold this point of view are Isserlin and various members of his group, notably Von Kuenburg. They have been particularly interested in studying "categorical behavior," which Goldstein believes disturbed in amnesic aphasia. This work will be discussed in some detail in the section on amnesic aphasia.[43] Suffice it to say in this connection that Von Kuenburg has been able to show by experiments in the classification of colors and of objects that normal behavior is not always controlled by a "categorical principle," and consequently that there can be no absolute differentiation between the aphasic and the normal on this basis.[44]

---

[40] F. Laubenthal, *Zur psychologischen Analyse von Kranken mit einem Syndrom der linken Parieto-Occipitalgegend,* Arch. f. Psychiat. u. Nervenkh., 1933, 99, 633–682.

[41] J. Lange, *Fingeragnosie und Agraphie,* Msch. f. Psychiat. u. Neur., 1930, 76, 129–188; *Probleme der Fingeragnosie,* Zsch. f. d. ges. Neur. u. Psychiat., 1933, 147, 594–610.

Isserlin and Von Kuenburg point out that the changes in behavior in aphasic patients often result from the inability to find words; non-verbal performances are thus abnormal only as a consequence of the language abnormality. The view is similar to Head's in that the disorder is thought to be primarily a language difficulty, but the German investigators emphasize a language deficit rather than a disturbance in symbolic formulation. In his recent discussion of the whole aphasia problem Isserlin has taken up the matter again, and presented as evidence of the importance of the speech defect for the disturbance in conceptual thought, not only Von Kuenburg's studies in classification but the experimental attacks on the problem of concept formation made by Ach (1921), Fischer (1922), Willwoll (1926), and Usnadze (1924).[45]

A second important piece of work along this general line has been undertaken by Lotmar in his study of difficulties in word-finding.[46] After experimental work with a large number of cases of brain injury, he has come to the conclusion that there is no need to assume a mental disorder to explain the speech inhibitions and that the primary difficulty is a speech difficulty.

---

[42] In a very interesting paper Klein (1929) has analyzed a case of Broca's aphasia with pronounced difficulty in spontaneous speech and in writing, and come to the conclusion that the difficulty lay not in the organization and use of thought material but in the lack of thought content. Thus he swings away from the emphasis on the disorder of function, as Goldstein, Van Woerkom, and Bouman and Grünbaum place it. At the same time he does not agree, at least for this case, with those who think the crux of the difficulty a language deficit. Klein traces it further back in the thought-speech process, saying that thought cannot emerge because thought content is impoverished.

[43] See pages 78–82.

[44] M. von Kuenburg, *Zuordnungsversuche bei Gesunden und Sprachgestörten,* Arch. f. d. ges. Psychol., 1930, 76, 257–352.

[45] M. Isserlin, *Die pathologische Physiologie der Sprache,* Ergeb. d. Physiol., 1931, 33, 91–98.

[46] F. Lotmar, *Zur Kenntnis der erschwerten Wortfindung und ihrer Bedeutung für das*

3. TYPES OF APHASIA

Nowhere in the aphasia literature is confusion more evident than in the classification of types of disorder. There are differentiations on anatomical, physiological, and psychological grounds and on various combinations of these. Physiological differentiations have been most numerous. They are difficult to interpret, for the terms "motor," "sensory," "visual," "auditory," and so forth have often been used to connote aspects of complex psychical activity. The difficulties inherent in this use of the terms caused Head to reject them absolutely. He stated the case with great clarity when he wrote:

> . . . we cannot . . . analyse normal speech strictly in terms of motion or sensation; most acts depend on both these factors for perfect execution. For the use of language is based on integrated functions, standing higher in the neural hierarchy than motion or sensation, and, when it is disturbed, the clinical manifestations appear in terms of these complex psychical processes; they cannot be classed under any physiological categories, motor or sensory, nor even under such headings as visual or auditory.[47]

The Four Forms of Disorder Outlined by Head

As one of the few classifications expressed in terms which indicate the psychological nature of the disorders, Head's merits particular attention. Its divisions represent the four different forms of the essential disorder of symbolic formulation and expression which Head believed he could distinguish in his series of cases.[48] Each of the four forms is designated by a

Denken des Aphasischen, Schweiz. Arch. f. Neur., 1919, 5, 206–239; *Zur Pathophysiologie der erschwerten Wortfindung bei Aphasischen,* same journal, 1933, 30, 85–158 and 322–379.

[47] Head, *op. cit.,* 203.

[48] It is important to note that the lesions in most of Head's cases were gun-shot wounds. He found this type of case advantageous because there was likely to be improvement and because the destruction was largely cortical, and consequently, in his opinion, led to less severe and more specific disorders. These views have been repeatedly questioned. Many of the vascular cases met in civilian practice also show improvement, and the course of the disorder can usually be studied more completely in such cases than in cases of war wounds, which come up for detailed study only some time after the injury, and often after preliminary operative treatment has made the exact amount of cerebral disturbance uncertain. Furthermore, the gun-shot wound case usually involves considerable cerebral disturbance, reaching beyond the cortex and far from calculable in its extent.

term descriptive of the predominant language disintegration in the particular form: the verbal, the syntactical, the nominal, and the semantic.[49]

1. *The verbal.* The most marked disturbance in this type is "defective power of forming words, whether for external or internal use." In severe cases, the patient may be able to produce only one or two words, aside from automatic expressions. His writing shows much the same defects as his speech. His understanding, however, is relatively satisfactory; except in the most severe cases, he appreciates the significance of words and can follow oral or printed commands. There are many signs that his disorder is more than a defect of articulation. The patient may not be able, for example, to arrange a series of letters in alphabetical order.

2. *The syntactical.* "This disorder of symbolic formulation and expression consists essentially in lack of that perfect balance and rhythm necessary to make the sounds uttered by the speaker easily comprehensible to his auditor. The phrase may be faulty and even single words are badly pronounced, although their nominal use and meaning remain intact. All those smaller words, such as articles and conjunctions, which bind together the more significant parts of the sentence, tend to be slurred or dropped."

Speech is rapid, and when the patient first fails to make himself understood, he starts in again with another torrent of words. There is not the parallel between the defects of speaking and of writing which is to be found in verbal aphasia. The syntactical patient can write better than he can speak, "because the defect is essentially one of balance and rhythmic utterance." He understands single words well, and he can follow commands except when they demand "the exact recall of a spoken phrase."

3. *The nominal.* The essential disorder here is a disturbance in the use of words as names and a difficulty in appreciating the nominal significance of words. The patient's vocabulary is fairly extensive and he recognizes the objects he cannot name. Given the names orally or in print, however, he cannot fit them to the appropriate objects. He has great difficulty in reading and writing and in drawing from memory.

4. *The semantic.* "This form of aphasia is characterised by want of recognition of the ultimate significance and intention of words and phrases apart from their direct meaning. But other functions suffer that have no immediate bearing on verbalisation; for there is loss of power to appreciate or to formulate the logical conclusion of a train of thought or action.

"The patient has no difficulty in forming words. . . . But in general conversation his sentences tend to tail away aimlessly, as if he had forgotten what he wanted to say. Reading presents no serious difficulty; but the full meaning is liable to be misunderstood. These patients can write, but the results tend to be inaccurate and confused; for semantic defects are more liable to disturb the connected sequence of what is written rather than its verbal form. They can count correctly, but have much difficulty with arithmetic and in recognising the relative value of money. Even drawing from a model shows considerable lack of constructive ability. They are completely unable to find their way alone; for they do not take their bearings and fail to recognize familiar landmarks."

---

[49] Head, *op. cit.,* 221–268.

Head's material was not, as he admitted, sufficient to determine the relation between these different types of language disorder and lesions of different cerebral areas. Most of his cases were traumatic and in many the lesions were too diffuse to be significant for the study of localization. Limiting himself to the more circumscribed lesions, however, he thought that he could draw certain conclusions.[50] In verbal aphasia, he found the lesion in the lower portion of the pre-central and post-central convolutions, while in syntactic aphasia the upper convolutions of the temporal lobe were affected. His examples of nominal and semantic aphasia did not admit of definite anatomical conclusions, for lesions in the supramarginal and angular gyri appeared with both types. In Head's opinion, however, a more posterior lesion was usually characteristic of the nominal disorder.

When Head outlined these four types of aphasia in 1920, he feared that the descriptive names he had been obliged to give them would "lead him to perdition; because everyone would settle upon them and think they meant something he did not intend"; and would overlook the most significant part of his theory, namely that "a vast group of functions were employed in the acts called speaking, reading and writing, and it was these which split up in certain ways to produce the clinical forms of disordered speech."[51] As a matter of fact, the subsequent literature has shown a rather widespread understanding and appreciation of Head's theory of aphasia as a disorder of symbolic formulation and expression. His four types of disorder have generally been regarded as of less importance. It is not the names which Head assigned to them, however, which led him to perdition. The purpose of a classification is to outline the most prominent types of disorder so that any investigator may use this standard for the convenient grouping and handling of his own cases, and Head's classification fails because it does not outline types which can be generally observed. Experience has shown that there are forms of disorder which do not correspond to any one of the four types, others which must be related to more than one type, and still others which manifest only part of the disturbances Head described as characteristic of the type.

---

[50] *Ibid.*, 442–473. In view of the technique by which the positions of the lesions were determined, the results must be interpreted with caution. Having no necropsies and often no operative findings, Head judged the site of the injury by reconstructing it on a cadaver, the head measurements of which corresponded as nearly as possible to those of the patient. Holes were drilled in the skull to mark the position and dimensions of the injury, and the surface of the brain underlying the holes was then colored.

[51] *Discussion on Aphasia*, Brain, 1920, 43, 449.

Aside from the work of Delacroix in France, there has been little direct criticism of Head's classification. That it is generally regarded as unsatisfactory may be judged from the fact that it has not been adopted. The verbal form, however, with the chief disturbances in word-formation but a disorder going far beyond the executive mechanisms of speech production, is undoubtedly a definite type of aphasia; it is similar to the cortical motor or Broca's aphasia of other authors. The syntactical form in Head's conception differs from the sensory aphasia which shows pronounced disturbances of speaking and also from the so-called agrammatism or paragrammatism, but partakes of the nature of these. The nominal form most nearly resembles the so-called amnesic aphasia; but, as Head describes it, it involves a difficulty in understanding the nominal significance of words which is less like the amnesic and more like the usual sensory aphasia. The semantic form is Head's particular contribution, unlike any form of aphasia previously described. The essential disorder in grasping the ultimate significance and intention of an act had been implied in connection with various other types of aphasia, but it had never been described so admirably.

The four types of aphasia represent, as already noted, different ways in which the process of symbolic formulation and expression breaks down. Head did not intend them to represent disturbances at different successive stages of this process. In summing up the essential facts in 1926, he wrote:

> Unimpeded symbolic formulation and expression cannot be analysed into a sequence of semantic, nominal, syntactical and verbal procedures following one another in time. The disorders of speech to which these names have been applied do not reveal the normal order of psychical events, but disturb the progressive development of language processes as a whole.[52]

On the basis of the 1920 lecture, however, Delacroix had already pointed to the correspondence between the hypothetical stages from thought to spoken expression and the forms of disorder Head outlined.[53] In 1926, Delacroix analyzed the relationship still further, and defined Head's four types of disorder in terms of defects at different stages of the normal language process:

---

[52] Head, *Aphasia and Kindred Disorders of Speech,* I, 547.

[53] H. Delacroix, *Le langage et la pensée,* 1924, 402–403.

Verbal aphasia: defect in the formation of articulatory and auditory habits
Nominal aphasia: defect in the connection of sign and significance
Syntactical aphasia: defect in grammatical arrangement
Semantic aphasia: defect in intellectual automatisms and non-verbal thinking.[54]

The forms of symbolic formulation and expression Head described are indeed so easily related to disturbances at different stages of the thought-speech process as outlined by Pick and other investigators that it is difficult not to consider them as such in spite of Head's explicit statement to the contrary.[55] The analogy is tempting, but hardly useful. There can be no doubt, as Pick himself noted and Delacroix agreed, that the stages from undifferentiated thought to speech expression are extremely variable, that they may overstep one another and that some of them may drop out in a given speech response. Furthermore, since Head's four types of disorder have not all been confirmed by clinical experience, it is futile to argue from them to the nature of the thought-language processes.

When Head's classification is compared with those which are more widely accepted at the present time, it seems superior to them in theory and inferior in practice. It is based on the right principle; that is, the differentiation of forms of language deterioration in terms descriptive of the predominant psychological changes. It is not, however, so successful a differentiation of the types of disorder as many which employ far less justifiable terms.[56]

Current Views on Types of Aphasia

No single classification is generally accepted at the present time, but there is a certain amount of agreement on a number of more or less clearly defined types of disorder. Roughly these may be divided into two main groups, the motor and the sensory or, as they are occasionally and better called, the expressive and the receptive. Within each of these groups there have been found cases of relatively uncomplicated disorders of the simpler executive mechanisms and receptive functions and also cases of more complex disorders which seem to involve higher language and thought processes. The differences have led to the distinction of the "pure" and the more complex forms of aphasia. The distinction was not made, however, simply on the basis of the clinical findings. The "diagram makers," as Head called them, supposed that there must be different types of disturbance with subcortical and with cortical lesions, and in constructing a schema of cerebral organization to show which speech centers were affected with particular forms of aphasia, they sometimes described a syndrome before any case was found. Thus the so-called subcortical sensory aphasia or "pure" word-deafness was differentiated before any cases were found to support the theory. This reasoning from the anatomical lesion to the syndrome has always led to difficulty because the clinical findings have been distorted to bring them in line with what the findings should theoretically have been.

---

[54] Delacroix, *L'analyse psychologique de la fonction linguistique,* 1926.

[55] For Pick's analysis, see footnote 34, pages 42–43.

[56] Hughlings Jackson very early warned against a mixed classification, saying that: "We must not classify on a mixed method of anatomy, physiology and psychology, any more than we should classify plants on a mixed natural and empirical method, as exogens, kitchen-herbs, graminaceae and shrubs." (Jackson, *Selected Writings of,* II, 160.) His warning has rarely been heeded, however, and most classifications employ both physiological and psychological terms.

The differentiation of pure forms of aphasia is one of the points of the classical doctrine to which Head was firmly and quite rightly opposed. Nevertheless "pure" motor aphasia and "pure" alexia are still fairly generally accepted. Word-deafness is not so widely accepted, but it remains an important part of the scheme for many investigators. Among the "pure" disorders, only agraphia has fallen into disrepute, and it is still postulated by Henschen and a few others.

The problem requires some discussion before the various types of disorder are considered separately. The exact significance of a "pure" form of aphasia has not always been clear. Logically it would seem that a pure form should be a disorder uncomplicated by any other disturbances; that pure word-deafness, for example, should be a difficulty in perceiving or understanding spoken speech uncomplicated by changes in expression, defects in reading, or any other language disturbance. The logical meaning, however, has often been disregarded, and various authors speak of a "pure word-deafness complicated by paraphasia and difficulty in word-finding." The confusion surrounding the concept of a pure form of aphasia has been further increased by the use of "pure" in certain specific and limited senses. Thus after Dejerine's work on word-blindness, a pure form of word-blindness sometimes meant word-blindness without agraphia. The case might be complicated by difficulties in speaking or word-finding and still remain "pure."

The inexact and the limited meanings attached to the term "pure" have increased the number of cases in the literature which are supposed to support the doctrine of pure forms of aphasia. Survey of these cases as they were originally reported shows few, if any, which actually do support the doctrine. Interestingly enough, the clearest cases are either early cases or cases where the reports given are inadequate. In other words, it would seem that the more adequate the study, the less likely is the case to appear pure. A survey of the literature, then, leads to the same conclusion which Head reached on theoretical grounds, namely, that pure forms of disorder in the sense of uncomplicated forms do not exist. Such a survey was necessary, however, because Head's position has not been generally accepted, and a large number of investigators still claim that pure forms of disorder do exist and point to the cases of the literature to substantiate their claim.

The so-called pure disorders stand, as it were, between the more complicated forms of aphasia, on the one hand, and different types of apraxia and agnosia, on the other.[57] As noted in the beginning of this discussion, there can be no doubt about the fact that some disorders appear predominantly in the simpler expressive and receptive functions and others in the more complex language processes. Nor can there be any doubt that the disturbance in one language process, such as speaking or reading, may be far more marked than the disturbances in any other process. Review of the cases in the literature shows that Head has gone too far in his insistence on the generality of the language disorder. The results of clinical experience seem to indicate a happy mean somewhere between his position and that of the classical doctrine.

In addition to the so-called pure and complex types within both motor and sensory aphasia, a number of other syndromes have been differentiated. Of these the most important is amnesic aphasia. Disturbances of the amnesic type appear in both motor and sensory aphasia, but there is ample evidence to show that the amnesic disorder may appear as an independent syndrome, apart from either of these forms.

The other types of aphasia which have been defined are apparently subordinate forms, or variations of the disorder in which some particular characteristic is unusually marked. Agrammatism and paragrammatism are phenomena which may appear with the complex form of motor and sensory aphasia and will be discussed in connection with these. There is not sufficient evidence to establish conduction aphasia (Goldstein, "central" aphasia) as an independent disorder and it is best considered in connection with the complex sensory disorder.

The types of aphasia which have been outlined by leading investigators are presented in Table I. Of these the three main types, the motor, the sensory, and the amnesic, will be discussed below; and in addition, the characteristics of the so-called pure motor and sensory forms will be described.

---

[57] For discussion of apraxia and agnosia, see pages 100–116.

TABLE I

EARLIER CLASSIFICATIONS OF APHASIC DISORDERS

<table>
<tr><th>BROCA</th><th>WERNICKE</th><th>MARIE</th><th>PICK</th><th>GOLDSTEIN</th><th>HEAD</th></tr>
<tr><td rowspan="3">Aphemia</td><td rowspan="3">Motor aphasia</td><td>Anarthria</td><td></td><td>Peripheral form of motor aphasia (subcortical motor; "pure")</td><td rowspan="2"></td></tr>
<tr><td rowspan="2">Broca's aphasia</td><td rowspan="2">Expressive aphasia</td><td>Transcortical form of motor aphasia</td></tr>
<tr><td>Central form of motor aphasia (cortical motor)</td><td>Verbal aphasia</td></tr>
<tr><td rowspan="4">Verbal amnesia</td><td rowspan="2">Sensory aphasia</td><td rowspan="2">Wernicke's or the true aphasia</td><td rowspan="3">Impressive aphasia</td><td>"Pure" word-deafness</td><td></td></tr>
<tr><td>Sensory aphasia (cortical sensory)</td><td rowspan="3">Different aspects introduced in nominal, syntactical, and semantic aphasia</td></tr>
<tr><td>Conduction aphasia</td><td rowspan="3"></td><td>Central aphasia</td></tr>
<tr><td></td><td>Amnesic aphasia</td><td>Amnesic aphasia</td></tr>
<tr><td></td><td>Total aphasia</td><td>Total aphasia</td><td></td><td></td></tr>
</table>

The discussion will cover the following forms:

Motor aphasia
(1) The "pure" or subcortical form
(2) The cortical form

Sensory aphasia
(1) The "pure" or subcortical forms
  a. Word-deafness
  b. Word-blindness
(2) The cortical form

Amnesic aphasia

In treating these types of aphasia, it is essential to bear in mind two points: first, that the types outlined by any investigator are to be understood on the basis of his theory of the nature of aphasia as a whole; and second, that statements on localization, however similar they sound, are actually of different significance if they are connected with different theories of cerebral organization. The two points are correlates, and an illustration of the second will suffice to make the matter clear. When he assigns the lesion in motor aphasia to the left third frontal convolution, the extreme localizationist, for example Henschen, means that this lesion destroys the function of articulate language which is assumed to be located in that particular area. The many investigators who are opposed to this point of view locate, in Jackson's words, the damage which destroys speech, but not speech. They differ somewhat, however, in their concepts of cerebral functioning, and consequently in the significance of their particular statements on localization. The differences may be illustrated by the views of Goldstein and of Pick. The former have already been presented in a quotation above: Goldstein thinks of localization as a definite distribution of excitation within a structurally differentiated nervous system, with a particular structuration of the excitation in a definite area. Pick was also opposed to sharp delimitation of parts of the anatomical system and emphasized the functional character of the cerebral center without, however, introducing the "field" concept which Goldstein upholds. In his last paper, Pick wrote:

> *Wenn im folgenden von "Zentren" gesprochen wird, so soll damit nur die jeweils funktionell bevorzugteste, deshalb auch nicht scharf abgrenzbare Partie eines Systems von Strukturzusammenhängen bezeichnet sein, denen mit zunehmender Verfeinerung sich ausbildende Funktionverbände entsprechen (nicht etwa der Sitz eines besonderen Vermögens, auch nicht im Sinne der Physiologie*

ein vorgebildeter, mit scharf umschriebenen Funktionen verbundener Apparat), durch deren (auch funktionelle) Läsion hervorstechendste, ihnen zugeordnete Leistungen am leichtesten geschädigt werden, aber auch andere funktionell damit vereinigte Verbände in verschieden abgestufter Weise mit gestört werden können.[58]

MOTOR APHASIA

The "pure" or subcortical motor form; word-muteness. A so-called pure motor aphasia has been rejected by Pick and Head, but is accepted by many investigators, among them Goldstein, Kleist, and the members of the French school who follow Marie in designating this form as anarthria. Goldstein substitutes "the peripheral form of aphasia" for "pure" motor, and describes the particular difficulty as a defect in the use of lip, tongue, and larynx muscles for the production of speech sounds, although these muscles can be used easily for other movements.[59] In Goldstein's opinion the presence of defects in processes other than in articulate speech depends largely on the individual patient. If he has been accustomed to speaking as he read or as he wrote, reading or writing will be affected. They are not, however, affected because of a disorder in the symbolic function. Goldstein believes that the distinguishing characteristic of this form of motor aphasia is that the symbolic function is normal. Head, on the contrary, finds that the symbolic function is affected in all cases and that there are no "pure" motor speech disorders. The patient's difficulty goes beyond the executive mechanisms of speaking and he cannot, for example, arrange a set of block letters in alphabetical order.

Review of the so-called pure cases in the literature shows that whether or not the disturbances can be attributed to a symbolic disorder, they always extend beyond the production of speech sounds in cases which are adequately studied and reported.[60]

---

[58] Pick, *op. cit.*, 1418.

[59] Goldstein, *Die Lokalisation in der Grosshirnrinde*, Handb. der norm. u. pathol. Physiol., 1927, 10, 763–774.

[60] There has been no recent survey of cases of motor aphasia. Consequently in an attempt to track down the so-called pure motor cases, it was necessary to go back to the survey Henschen made in 1920–1922. From the cases he gave in the section on frontal and central lobe lesions, were selected those which seemed to be little complicated by language disturbances other than in speaking. The original reports were then read for this selected group, and the least complicated of these cases are summarized below. In addition, the summary includes cases selected from Moutier's list of cases of so-called subcortical motor aphasia (1908), and also the supposedly pure cases reported since Henschen's work.

Boinet (1871). Man of 25, wounded over the left central areas where abscess later

The pure motor aphasia, according to the classical doctrine, was of subcortical origin, with a lesion which cut off the Broca area from the deeper centers. Modern opinion on the subject is considerably divided, and the different views in 1927 were well brought out by Goldstein in an extensive analysis of the subject in the section of *Die Lokalisation in der Grosshirnrinde* cited above. Goldstein does not believe that the lesion in this form of

formed. Shortly after the injury, patient could not speak, understand, or make himself understood in any way. About 7 months later, condition was that Moutier classified as subcortical motor aphasia, but original author reported that patient did not seem to understand what he read and had difficulties in writing longer words to dictation.

Charcot (1883). Man of 49 years. Included in Moutier's list of "pure or subcortical motor aphasia," but reported by Charcot as one of the rare cases "almost isolated" from the usual severe defect in intelligence. Patient was at first unable to understand spoken language or printed material. About 4 months later, while inability to articulate words persisted, understanding improved and the patient could write. No paralysis of tongue or lips or difficulty in deglutition. Charcot noted that in writing the patient often omitted conjunctions or prepositions, but in rereading was able to put them in; early description of the agrammatism so frequent in motor aphasia. Spelling errors rare. If patient wanted to write he had to isolate himself, for writing was "more of a task than it used to be." Excellent account of case and particularly interesting that this great master of observation should say that "weakening of intellectual energy is a pretty regular thing in these cases," and that it is well to recognize with Trousseau that there is not an aphasic, however limited the change, "who cannot be considered as suffering intellectually."

Dejerine (1885). Man of 20 with pulmonary tuberculosis. Loss of speech at first transitory and then permanent. Could say only "bu, bu, bu," or "yes" in answer to questions. Reported to understand questions, read, write, and calculate and show no defect in intelligence. Probably one of the clearest cases, but tests insufficient to bring out slighter disturbances. Few facts noted other than that he could hold up fingers to show number of brothers and sisters, and point out name of his occupation among several printed names. Autopsy: meningitic lesion occupying the two convolutions of the Rolandic fissure and of the Island.

Banti (1886, as reported by Bastian, Case XXII, 1898). Man of 36 years; right-handed. Attack of right hemiplegia which cleared up very quickly, and loss of speech which persisted. Patient could not articulate a single word or syllable but he could write spontaneously and write the names of objects. Writing said to be correct and rapid, and understanding for oral and written directions good. Autopsy: softening of posterior third of left third frontal convolution.

Dickinson (as reported by Bastian, 1898). Marine engineer of 49, admitted to the hospital unconscious. Consciousness and intelligence recovered in 1½ hours, but not speech. Right hemiplegia. Had been able to use both hands equally. Could not say anything but "no," but wrote fluently with the left hand. Understood perfectly. On the 24th day after the attack, suddenly regained speech. Motor power improved gradually.

Kostenitsch (1893). B., man of 54 years. Listed by Moutier as a "subcortical" syndrome with a cortical localization, but not expressly stated by the original author as "pure motor." Right hemiplegia and aphasia of 17 years' duration. Patient "completely aphasic," but could understand oral speech, read with full understanding, write his history (left hand), write names of objects, do simple calculations in his head, draw, and sing tunes without words. Sample of his writing shows abbreviated style with suggestion of agrammatism. Autopsy: complete destruction of left frontal lobe.

Leva (1893). Case III, H.H., man of 61 with "pure motor aphasia" and right hemiplegia. Said to have a good understanding for speech and a good vocabulary. Unable to aphasia is subcortical and in the more complex form cortical. He agrees with Von Mayendorf as to the importance, if not the exact role, of the *operculum centrale* for motor speech.

Cortical motor aphasia. The cortical form of motor aphasia is understood to be a much more complex disorder than the so-called pure form. It is Broca's aphasia, which Marie believed to involve an intellectual deficit as

write to dictation correctly, however. Writing from memory said to be correct. Unable to read because of bad vision. Autopsy: softening in third frontal and anterior central convolutions.

Case V, C.B., woman of 41. Right hemiplegia and "pure motor aphasia" on second attack. Summary report only: voluntary speech and repetition said to be confused; understanding for oral speech and memory good; understanding for reading intact. Chronic endocarditis. Autopsy: softening in the lenticular nucleus.

Idelsohn (1898). Man of 53, who had left homonymous hemianopsia for several years. Lost speech suddenly, but could still understand and could show that he recognized objects by using them. Said to show no agraphia, but confused the order of words in the sentence and letters in the word after he had written a line or two. Improved under anti-syphilitic treatment and could say almost all words; then clear that he made slight errors in naming objects, e.g., "book" for "briefcase." Clearly not an "isolated" motor aphasia, and probably not of "motor" type.

Marburg (1899). Woman of 50 with several embolic attacks. One of the many cases described in terms of theory rather than actual fact: loss of voluntary speech, repetition, and oral reading with preservation of writing, understanding of oral and printed speech, calculating, and drawing. Additional facts noted give a better idea of her condition: could not indicate number of syllables in words she could not pronounce because she did not understand "the concept of syllables"; low intelligence level which partly but, as the author noted, not entirely explained her poor writing. Wrote with her left hand in mirror script.

Ladame and Von Monakow (1908). Woman of 55 who had been unable to speak for 10 years. Said to have understood everything at the time of the attack. Three days afterward could write a few words and from the ninth day could write fluently. Writing to dictation, reading, and inner speech also said to be intact, but reported to fatigue easily so that she did not like to read or calculate. Intellectual faculties gradually became weaker. Also reported to show difficulties in deglutition, which the authors thought of psychic origin. Autopsy: lesion of the left third frontal convolution, cortical and subcortical, and of the operculum of Rolando.

Bonvicini (1914). Man of 26, originally left-handed. Aphasia at first complete and accompanied by apraxia. Ten days after attack, understanding began to improve, and four weeks later patient could read, and write his name and many other words. A relatively clear case, but sufficiently well studied to show complications. Able to write with the left hand almost as well as before, but unable to construct words as long as two syllables from separate letters. Bonvicini noted a disturbance of writing, but pointed out that it was very slight in contrast to the high-grade loss of speech. Apparently able to do only easy calculations. Autopsy: extensive destruction in the tissue of the left central, the foot of the third frontal, and the supramarginal and angular convolutions.

Dufour and Nativelle (1927). D., man of 54. A very brief report: understanding of spoken language and reading said to be intact, with some ability to form with the left hand letters of words he cannot say. Not well enough studied to show how far disorder extended.

Souques (1928). A. Del., postman of 30 years. One of the clearest cases: at examination, two years after attack, patient could not articulate a word and could produce only a few speech sounds. According to the report he could tell the number of letters or syllables in the well as a speech difficulty, verbal aphasia as defined by Head, and the "central" form of motor aphasia as defined by Goldstein. This disorder is characterized not only by difficulty in articulation and retarded, scanty speech, but by widespread disturbances in processes not directly concerned with the production of speech sounds. In fact, the "motor" disturbances are subordinate to the more complex disturbances in propositional expression. Head found excellent examples in these patients of the disorder of symbolic formulation and expression; Van Woerkom found them defective in "geometric sense" and unable to represent spatial relations apart from the situation; Goldstein found that they could not analyze or abstract and were thus unable to pick out the essentials in a field, i.e., to hold the figure clearly against the ground.[61]

Defects are to be found in writing as well as in speaking, although not always to the same degree.[62] They are, however, similar in nature; words, and sometimes letters, are misformed in writing and the sentence structure

---

words he could not pronounce; follow any orders, oral or printed; understand what he read; write quickly and correctly either spontaneously or to dictation with the left hand; and add, subtract, or multiply several-place numbers accurately. The difficulties with this case as a proof of "anarthria," or a disturbance which does not go beyond the articulation of speech, are: 1) that no thorough studies are reported as to just how much the patient could understand or write; 2) that no tests of vocabulary or intellectual functions are included; and 3) that no examinations were made until two years after the attack. The author credited the family's report that the patient had always been able to understand and write. It is obvious, however, that in a speechless patient many defects may pass unnoticed without thorough examination. At the time of the examination studies of the larynx were negative and there was no difficulty in deglutition. In the author's opinion, however, respiration and phonation were affected as well as articulation itself. Two years after the examination the patient was reeducated, and in a few months learned to pronounce all that he wanted to say, but slowly and with abnormal separation of the syllables. It was then clear that he showed agrammatism; he left out the less important words in speaking. Whether this was a conscious adaptation to the difficulty in articulating or whether it represented the abbreviated sentence structure of the complex motor aphasia is not noted. Autopsy: extensive lesion, with destruction of the first and second frontal convolutions, softening of the third frontal, small lesions in the operculum of Rolando and the inferior parietal convolution, and great damage in the lenticular zone and the Island.

Feist and Sittig (1929). R.S., a man of 33, with skull injury of right parietal and temporal bones. Understanding slightly disturbed, but patient could write many words he could not speak and is therefore said to be a case of "pure motor aphasia in the classical sense."

Sittig (1931). W.B., young man of 24. Probable epidemic encephalitis. Spontaneous speech at first limited to "no"; some errors in understanding spoken language and print (did not point out all objects correctly); mistakes in writing. Four months later when speech was much improved, said to show classical subcortical motor aphasia, but still some hesitancy and error, in spite of the fact that tests were limited to relatively simple performances.

[61] Goldstein, *op. cit.*, 778.

[62] It has been said that few investigators postulated a pure agraphia. Nevertheless there are frequent cases where the motor or expressive changes are more marked in writing than

may suffer as the sentence structure in speaking does. Furthermore, while the disturbances predominate in the "motor" or expressive processes, there is more or less limitation in understanding.

The lesion underlying disorders of this type is thought to involve not only the third frontal convolution, but a larger area including the neighboring part of the frontal lobe and the anterior part of the Island.

One of the most interesting expressive changes often found with the cortical form of motor aphasia is the abbreviated sentence and grammatical structure described by the German authors as "agrammatism" and by the French as "telegram style." In the abbreviated sentences there is a tendency for the main words to be preserved as in a telegram, and for the auxiliaries and relational words to be omitted. In a language like the German inflections are usually neglected.[63]

Grammatical disturbances were first studied intensively by Pick who saw in them an approach to the complex problems of language and thought. He differentiated between the agrammatism described above, which ap-

---

in speaking. Sometimes the expression or word-formation is at fault; sometimes the defects are most pronounced in letter-formation, and the tendency then is to relate them to apraxia rather than to aphasia.

Within recent years there has been interesting work on a disorder in which agraphia is prominent together with arithmetical and spatial disturbances and finger agnosia. Gerstmann described the syndrome of finger agnosia, right-left disorientation, and agraphia in 1924 and it has since been called by his name. In 1927 he presented two more cases; all three showed marked difficulty in calculating. Meanwhile in their monograph on agraphia Hermann and Pötzl had reported a case of tumor in the transitional region between the second occipital and the angular gyrus, and similar clinical findings (1926). Lange's case in 1930 showed a lesion in the angular gyrus and the posterior parts of the first and second temporal convolutions; clinically there was difficulty in naming and reading as well as the characteristic changes in writing and calculating and the finger agnosia. The author believed, as already noted in the previous section, that all the changes depended on a disorder of direction in space. Klein's case, on the basis of which he assigned the disorder to the sphere of the differentiation of the hand, showed a tumor of the left parietal lobe and severe agraphia, slight finger agnosia and a disturbance in right-left orientation (*Zur Symptomatologie des Parietallappens,* 1931). Another case has been reported recently by Singer and Low, with marked disturbances in both writing and calculating (*Acalculia* [*Henschen*], 1933). Still others have been noted on pages 44–45 above in connection with the essential nature of the disorder, and cases where apraxic and agnosic disturbances predominate over the aphasic are discussed in the section on apraxia and agnosia in Chapter IV.

[63] Pick pointed out that this aphasic disturbance will appear differently in an inflected language and in a language like English where "the telegram style is the normal." Aside from some of Head's patients, there have been very few cases of grammatical disorders reported in English-speaking patients. Low in a recent paper expressed the opinion that cases suitable for detailed study might be rare or rudimentary among the English-speaking (1931). It may well be that cases are less pronounced in English than in German because of differences inherent in the two languages, but they probably occur in corresponding numbers.

pears with motor aphasia, and a different type of grammatical change which he called "pseudo-agrammatism." In the second type word-order is altered and prefixes, suffixes, and inflections are confused rather than omitted. Bonhoeffer, Kleist, Goldstein, Salomon, and Isserlin agree in distinguishing between agrammatism and the second type, which Kleist has called paragrammatism, and in relating the latter to sensory aphasia.[64]

Agrammatism, however, is often somewhat complicated by the confusions characteristic of paragrammatism. Furthermore, the style is never that of a perfect telegram, nor is there conscious omission of all but the essential words. The changes are not only involuntary, but they may even occur without the patient's being aware that he is speaking differently from the normal. Usually, however, the motor aphasic is aware of his errors while the sensory aphasic is not.

The abbreviated form has been explained by Isserlin as the result of the motor aphasic's "speech need."[65] The patient of this type has great difficulty in uttering words; consequently his attitude toward speech expression changes and that expression takes a different form. The new form is not to be considered as erroneous speech, but rather as a more primitive type of expression related to that of deaf-mutes, of children at certain stages of development, and of adults when speaking in a tongue they do not know well or in situations of great urgency. Isserlin believed this hypothesis strengthened by the fact that patients who showed marked agrammatism in speaking were often able to write fairly well; thus when the attitude toward the expression was different and less rapid adjustments were required, the performance improved.

There can be no question, as Pick said, of localizing grammatical knowledge or feeling for speech at any place in the cerebrum. Most investigators, however, suppose that the motor type of syntactical defect discussed here is related to frontal lesions at or near the Broca area, and that the syntactical confusions of paragrammatism appear with lesion of the Wernicke area, particularly the second and third temporal convolutions. Some few, notably Von Mayendorf, think agrammatism the result of activity of the right hemisphere when the corresponding areas on the left have been destroyed. It has been shown, however, that agrammatism may not only appear but may be more severe with bilateral lesions.

Another form of motor aphasia, the so-called *transcortical,* is supposed to be characterized clinically by great difficulty in spontaneous speech together with fairly satisfactory repetition. Pick, Von Mayendorf, Foerster, and many others reject this as an independent form, but believe that it represents a phase in the recovery from cortical motor aphasia. Goldstein does not think that the superiority of repetition over spontaneous speaking is a sufficient ground for assuming a particular localization for this form. He would attribute it to a slighter lesion of the motor speech area. He believes that a syndrome similar to the transcortical motor aphasia is characterized by a disturbance in the intention to make movements, particularly the movements necessary for speech.[66]

---

[64] See pages 72–74. For general discussion of the problem, see Isserlin, *Ueber Agrammatismus,* Zsch. f. d. ges. Neur. u. Psychiat., 1922, 75, 332–410; Pick, *op. cit.,* 1469–1477.

[65] Isserlin, *op. cit.,* 394–401. Isserlin noted that Liepmann and Kleist were of the opinion that the sensory as well as the motor aphasic might show speech poverty, and therefore that the telegram style might appear from the same cause in both types of patient. In the case of the sensory aphasic, however, it was complicated by the other grammatical changes characteristic of that form of disorder.

SENSORY APHASIA

The "pure" or subcortical forms: word-deafness and word-blindness. The general question of the so-called pure types has already been discussed at some length. Although the literature does not give sufficient evidence of them, pure word-deafness and pure word-blindness are still maintained by a number of investigators. The situation with regard to each of these forms will be discussed briefly below.

In connection with the use of the terms *word*-deafness and *word*-blindness, it must be noted that the usual meaning is a difficulty in perceiving the speech sounds or letter symbols and in understanding them. Only those investigators who analyze speech into sounds, words, and sentences, as Kleist does, assume the possibility of a word-deafness, for example, apart from a speech-sound-deafness or sentence-deafness. Many authors have complained about the inaccuracy of the terms, but they continue to be used none the less.

a. Word-deafness: It has already been said that word-deafness is less generally accepted as a pure disorder than word-blindness. The term is often used to indicate one disturbance in a more complex disorder, and then means simply a difficulty in perceiving or understanding spoken speech. The so-called pure disorder is this difficulty apart from any change in speaking, reading, or writing. Its characteristic, as opposed to the cortical sensory aphasia, used always to be stated as intact inner speech. The only defects which appeared in addition to those in perceiving or understanding speech were in repeating and writing to dictation, and these were natural secondary results of the primary difficulty. The word-deafness was not necessarily a complete loss of appreciation of spoken language. Often patients could repeat a few speech sounds and understand some words.

---

[66] Goldstein, *op. cit.*, 774.

The so-called pure word-deafness was supposed to be less likely to improve than cortical sensory aphasia. It was found to be characterized by a decrease in reaction to auditory stimuli, a change which some cases of cortical sensory aphasia also showed.

Difficulties in the perception of speech sounds were sometimes marked, and they were sometimes accompanied by defective appreciation of melodies, noises, and other auditory stimuli. Such cases were usually related to cases of auditory agnosia, whereas patients whose most prominent difficulty was in the understanding of speech were grouped with the aphasic cases. There can be no doubt that the disturbance is sometimes more marked in the appreciation of speech sounds and sometimes in the appreciation of meaning. It seems impossible, however, to draw any line between the two disturbances, and classify the one with auditory agnosia and the other with aphasia. Actually most cases have shown not only difficulty in appreciating both sounds and meaning, but an irregularity in the relation between the two processes so that the meaning was occasionally grasped when the sound was not.

Survey of the literature shows that the supposedly pure cases have been complicated by various disturbances, some of them in language processes and some in hearing. Ewing's recent work demonstrates the need for more thorough studies of auditory sensitivity than those which have been usual in the past.[67] The percentage of hearing for speech must be determined as well as the percentage of hearing for tones or noises.

Other so-called pure cases have shown some paraphasia at the time of examination. Still others have shown extensive language disorders at first, followed by unequal improvement so that the defects in the perception and understanding of spoken language remained when all other language disturbances were thought to have vanished.

As reported by Bonvicini, most of the cases of word-deafness in the literature up to 1929 were complicated by some other disturbances.[68] He himself believes, however, that pure cases exist, and he lists a few which seem to him to fit the requirements. Survey of these and of the cases where he does not specify the condition of the other language processes shows no well-studied case of so-called pure word-deafness which is actually free from other language changes.[69] It is evident, however, that difficulty in perceiving or understanding spoken language may be far more pronounced than any other disturbance and that this condition has most often been observed in the recovery from a more complicated sensory aphasia.[70]

---

[67] A. W. G. Ewing, *Aphasia in Children*, 1930.

[68] Bonvicini, *op. cit.*, 1648–1673.

Survey of the clearest cases shows that this predominant disturbance in perceiving and understanding spoken language may occur with bilateral or with unilateral lesions, but that bilateral lesions have been most frequent.

---

[69] The facts about these cases, in brief, are as follows:

Van Gehuchten and Goris (1901). Man of 40. Character changes. Reported to speak perfectly before operation but with a tendency to verbiage; after operation paraphasic. Word-deaf. Reading not disturbed. Spontaneous writing *not tested before operation;* paraphasic after operation. Autopsy: unilateral lesion, abscess deep in the middle part of the second temporal gyrus.

Liepmann (1903). Case Gorstelle; age 67. Difficulty in grasping speech sounds and in understanding speech. Spontaneous speech said to be without error. Slow in understanding what he read. Unskilled in writing and could not spell, but could write his name. Did not recognize melodies. Autopsy: unilateral subcortical lesion of left temporal lobe.

Bonvicini (1905). Case St.; age 63. Extensive disturbances in speech and memory after each of two attacks, but in recovery from second, word-deafness most marked difficulty. Autopsy: bilateral lesion.

Barrett (1910). Man of 67. Right ear tone-deaf and left defective for lower tones. Marked disturbance in speaking at first, with improvement until speech disturbed only occasionally by paraphasia or difficulty in word-finding. Inability to understand spoken speech persisted. Occasional paraphasia in writing. Autopsy: bilateral lesion of first and second temporal convolutions.

Stertz (1912). Man of 48. Tabetic. Slight paraphasia in speech and difficulty in naming objects. Word-deafness which improved somewhat. Understood printed directions. Errors in writing.

Man of 52. Clear signs of dementia paralytica. Some paraphasia in speaking and in naming objects. Word-deafness. Understood something of what he read. Paraphasia in writing.

Henschen (1905 and 1917). Case Clara Nilsson; age 54. Amnesic aphasia, word-deafness, and difficulty in reading and writing after second attack. Speech cleared up and she could read with understanding. Writing poor, however; wrote only simple words and left out letters. Autopsy: bilateral destruction of first and second temporal convolutions.

Henneberg (1918 and 1926). Accountant of 43. Initially severe disorders in all language processes, with more rapid improvement in speaking than in understanding speech. Defects in understanding then relatively clear, but speech less flowing than normal and spontaneous writing showed unusual turns of phrase. Autopsy: unilateral lesion in caudal third of Island affecting subcortical tissue of Heschl's convolution and of superior temporal; another focus, cortical, in middle third of superior temporal.

Schuster and Taterka (1926). Woman of 68. Speech fluent, but vocabulary somewhat limited and occasional signs of literal paraphasia. Great difficulty in grasping speech sounds and in understanding speech and also melodies and noises. Wrote correctly with either hand; mirror script with the left. Autopsy: unilateral lesion on the left, relatively small focus involving only white matter of Heschl's area and to a slight extent the posterior part of the first and second temporal convolutions.

[70] O. Pötzl, *Einiges zur Symptomatologie der temporalen Aphasien* (1928), reported that he had twice observed "pure" word-deafness *followed* by disturbances characteristic of the more complicated sensory aphasia.

The site of the crucial lesion has always been said to be subcortical. Goldstein, however, does not believe that the disturbance is the direct result of subcortical destruction, but of the non-functioning of a cortical field. He eliminates Heschl's convolution and the Wernicke region, lesions of which would lead to cortical deafness and cortical sensory aphasia respectively, and thinks the important area probably the middle part of the first temporal convolution.

b. Word-blindness: "Pure" word-blindness or alexia is essentially a disorder in the perception or understanding of letter- or word-forms, existing apart from any other language or agnosic disturbances. In addition to this fundamental condition, the early investigators mentioned certain other characteristics of the disorder: an ability to read numbers in spite of the failure to recognize letters; a tendency for the recognition of letters to be aided by tracing them with the finger; a lack of improvement in the disorder with time; and, neurologically, a right homonymous hemianopsia. The exact nature of the reading difficulty was found to vary: some patients failed to recognize more than one or two letters; others could read letters but could not read words. This difference led to the distinction of a "literal" and a "verbal" alexia. Analysis of the cases in the literature shows that there is no sharp distinction between the two types. By far the larger number of cases are mixed, and most of the patients of the so-called verbal type make some errors with letters as well. Much depends naturally on the way in which reading has been learned, the nature of its functional relationships to speaking and writing, and the type and extent of the reading the patient has done—all factors which have been too often neglected in aphasia studies.

Word-blindness, like word-deafness, is a disorder which has two components, or better, two aspects. The one, the failure to recognize letter- or word-forms, has often been related to visual agnosia, and this relation has been particularly emphasized when the cases of word-blindness showed, as many of them have, defects in the recognition of objects, pictures, or colors, and perhaps spatial disorientation.[71] The relation to aphasia has been emphasized in cases where writing was somewhat disturbed and also where there was difficulty in word-finding. Incidentally the frequency of paraphasia with word-deafness and of difficulty in word-finding with alexia becomes clear from survey of the literature. With regard to the distinction of an agnosic and an aphasic form of word-blindness, the situation is similar to that already discussed in connection with word-deafness. While many patients show a predominance of the agnosic type of disturbances or a predominance of the language disturbances, there is always overlapping. Furthermore, as soon as letter or word errors are involved, it becomes evident that there is no invariable relation between adequate perception and adequate understanding.

---

[71] There are a great many investigators who relate alexia to visual agnosia, notably Von Monakow, Pötzl, Goldstein, and Marie.

There are a good many more cases of the so-called pure word-blindness in the literature than of pure word-deafness. The larger number of cases probably results in part from the several meanings of the word "pure" in connection with word-blindness. As noted above, a pure word-blindness has often been maintained if the disorder was without agraphia. Moreover, the disorder has been said to be pure if the "inner speech apparatus" was not affected, and a verbal amnesia was not considered a sign of disturbance in inner speech. Actually the well-studied and fully reported cases in the literature are not pure in the sense of being uncomplicated by other language disturbances.[72] The most frequent complicating factor is a dif-

---

[72] A fairly extensive, but still not complete, survey of the literature has been attempted, with particular attention to the "pure" cases reported or quoted by Pötzl in his 1928 monograph on the agnosias and by De Massary in his 1932 paper on alexia. In so far as they are reported by the original authors, the essential facts about the purest cases, or the cases most often accepted as pure, are given below. (One of the cases De Massary cites as absolutely pure clinically is not included because the original author [Redlich, 1895] found the case complicated.) It must be noted that there are more cases to include here as relatively pure than there were cases of word-deafness, a fact which is probably not just the result of a more thorough study of word-blindness.

Dejerine (1892). Man of 68. Right homonymous hemianopsia. Spontaneous speech reported to be easy and correct. Understood everything said to him, but could not read a word or recognize a letter. Recognized numbers but not musical notes. Spontaneous writing and writing to dictation reported to be perfect, but actually showed some paraphasia. The writing disorder persisted with the alexia, and became much worse just before the patient's death five years later. Autopsy: recent lesions of the second parietal and the angular gyri and old lesions of the occipital lobe and the splenium.

Hinschelwood (1895 and 1904). Man of 58; a teacher of French and German. Right homonymous hemianopsia. Reported to show not the slightest difficulty in speaking or naming objects. Could understand spoken speech perfectly, but could not read. Could write with perfect fluency. This seems to be one of the clearest cases in the literature, and it would be unassailable if facts had been given in greater detail. It is worth noting that the case was not "pure" a year after the attack for the patient then complained of defective memory, particularly for proper names, and he made spelling errors in writing. Autopsy, 8 years later: lesion of the calcarine fissure.

Brissaud (1900). Man of 50 brought into the hospital critically ill and given only superficial examination, which indicated good speech and writing but inability to read. Family reficulty in word-finding. There are, however, a number of relatively clear cases where the word-blindness is by far the most marked disturbance. Some of these cases earlier or later showed more extensive and general language disturbances; others showed visual agnosia for colors, objects, pictures, etc. When slight amnesic or other language or intellectual changes have been present in addition to the alexia, it has often been contended

ported that he sometimes seemed unable to recognize objects. Died a few days later. Autopsy: softening in left calcarine region and degeneration of splenium and tapetum.

Elder (1900). Case III, woman of 67. Difficulty in recalling proper names and nouns and slight impairment of memory for events. Could understand spoken language but could not read. Repeated some words and sentences in writing.

Bard (1902). Man of 56. Epileptic attacks and right homonymous hemianopsia. Operated without improvement. Intellectual faculties slow and memory impaired. No "appreciable alteration of inner speech," but alexic. Had trouble in writing but was not agraphic.

Dide and Botcazo (1902). Speech disturbed by marked amnesia. Apparently "pure" because it did not involve writing disturbance. Loss of topographic sense. Autopsy: bilateral lesions of the lingual gyri.

Storch (1903). Man of 63. Right hemianopsia. Speech had been unclear at first, but said to have no aphasic disturbances other than that he lacked a word sometimes, and could not tell a long story but had to be asked questions. Speech understanding good. Marked alexia. At first some difficulty in recognizing objects. Said to write well, in consideration of hemianopsia and difficulty in reading.

Man of 52. Right hemianopsia. Paused in speaking, substituted general for specific word, and erred in naming objects. (The author thought the case pure because he did not believe difficulty in word-finding a sign of disorder in the speech field.)

Levi and Taguet (1905). Man of 65. Right homonymous hemianopsia. Showed difficulty in word-finding and alexia. Alexia said to be pure because there was no agraphia.

Paterson and Bramwell (1905). Case II, man of 63. Right homonymous hemianopsia. Memory poor, but speech and understanding of spoken language good. Could not read letters or words, but could read numerals. Could write spontaneously and spell. Autopsy: lesion of distribution of left posterior cerebral artery.

Bonvicini and Pötzl (1907, reported by Pötzl, 1928). Case Setzka; age 82. Right homonymous hemianopsia. Amnesic aphasia, which improved, leaving him able to recognize most letters but unable to read words. Had always read by spelling. Writing correct. Autopsy: a small lesion, two superficial softenings on the inner surface of the left occipital lobe which enclosed the apparently undisturbed calcarine area.

Heiligtag (1910). Man of 25 with Y–shaped fracture between left occipital and parietal bones. Slight right homonymous contraction of the visual field. "No motor or sensory aphasic disorders in the narrow sense." Said to articulate, understand, and write correctly. Could read numbers up to three places and recognize objects. Alexia would seem pure, but no data are given to prove that speaking and understanding spoken language were entirely undisturbed.

Pötzl and Wertheimer (1910–1912, as reported by Pötzl, 1928). Case Spitz; man of 56, Right hemianopsia. Initial amnesic aphasia, which disappeared, leaving only severe visual agnosic disorders for letters, numbers, and colors, and slight for geometrical forms. In later years there were errors in writing and the patient deteriorated intellectually, but the alexia improved.

Dejerine and Pélissier (1914). First case (two others reported in same paper less clear). Right homonymous hemianopsia. Slight paraphasia at first, and difficulty in naming which that they were not sufficient to explain the alexia. The contention is true: neither change explains the other. The important fact is that an isolated change in a single language process does not appear when satisfactory studies are made. The language change certainly does not affect all processes equally, and it may not be appreciable in some, but it is a complex disintegration which is never limited to a single language process.

On the question of localization of the so-called pure word-blindness, there is now fairly close agreement. The constant right homonymous hemianopsia indicates a lesion near the basal half of the visual fibers and the purest cases coming to autopsy have shown a lesion in the tissue of the lingual gyrus, with destruction usually extending to the fusiform gyrus, the optic radiations around the lateral ventricle and the splenium of the corpus callosum.

persisted. Understanding of spoken language good. Recognized a few letters but not words. Writing perfect.

Pötzl (1904–1917, as reported by Pötzl, 1928). Case Sch., man of 26. Right homonymous hemianopsia. At first slight aphasic disorders which affected sentence understanding; also difficulty in word-finding and paraphasia, both of which lasted longer than the disturbance in understanding. Alexia later said to be pure, but he had difficulty in naming objects and sometimes got the name only by writing it, and he made some errors in writing.

Pötzl (1922, as reported 1928). Case Franziska B., age 59. Right homonymous hemianopsia. Great difficulty in remembering names, which improved, leaving, however, some difficulty in naming pictures at the time of examination. Alexia of verbal rather than literal type. Could read numbers. Writing "prompt."

Baruk and Hartmann (1927). Woman of 58. Right homonymous hemianopsia. Disturbance in memory for recent events and poor spatial orientation. Speech said to be normal and understanding good. Severe alexia. Spontaneous writing perfect and rapid. Some defects in recognizing objects. Unable to do mental arithmetic.

Lhermitte, De Massary, and Huguenin (1929). André A.; age 18. Right homonymous hemianopsia. Alexia of traumatic origin. Reported to be without anarthria, difficulty in word-finding, word-deafness, agraphia, agnosia or any disturbance of inner speech. At the same time, left out letters in writing, was slow in answering questions and in calculating, and showed defective memory, particularly for school knowledge. Sense of orientation in space disturbed.

Beringer and Stein (1930). Woman of 64. Right homonymous hemianopsia. Reported to be a pure case but details of performances other than reading not given.

Ehrenwald (1930). Case F.K.; man of 52. Right homonymous hemianopsia. Speech at first difficult to understand but cleared up in two weeks, leaving only alexia. At the same time patient said to have occasional difficulty finding words. Writing not disturbed, and no gross disorders in calculation. Some agnosia for objects and colors. Several epileptic attacks followed by amnesic aphasia, more severe alexia and disturbance in writing. Autopsy: recent pontile hemorrhage and an old softening in the tissue of left lingual gyrus.

Ranschburg and Schill (1932). Jos. K., age 62. Right homonymous hemianopsia. Slight hesitations in speaking and occasional perseverations. No difficulty in understanding speech. Almost complete alexia at first. Some errors in writing. Some difficulty in recognizing geometrical forms and in getting the meaning of *Gestalten* as wholes.

Detailed studies of individual cases of alexia with a view to determining the essential nature of the disorder have proved of great interest. In accordance with the modern tendency, the approach here has been dynamic and attempts have been made to understand the functional relationships which the difficulties in reading bear to the other pathological changes. During the War a notable and extensive work was done by Poppelreuter on patients with brain injuries resulting in visual disturbances ranging from field defects to difficulties in complex processes of recognition and in reading and writing.[73] Poppelreuter related alexia to a more general visual agnosic disorder, finding in both an "insufficiently differentiated understanding," with recognition of the general but not of the particular in the various test forms.

In his 1930 case, Wolpert has attempted to trace all the disturbances to a primary disorder which is like that Poppelreuter defined.[74] Wolpert expresses it as a "weakness in differentiation." He thinks this difficulty in separating the single elements responsible for the agnosic errors and the defects in reading and also for the various expressive changes—failures in imitating movements, slowness in speech and disturbance in word-finding, changes in writing, and so forth. As already noted in the discussion on the nature of aphasia, Wolpert thinks the fundamental disorder a disturbance in memory activity.[75] He found, for example, that his patient had trouble giving the names of a series of objects in a class, and in this resembled a patient of Kramer's.[76] Kramer sought to explain the difficulty as an inability to grasp the parts of a general concept. Wolpert in his explanation, however, emphasizes not the fundamental thought disorder but a memory defect with consequent lack of thought material.

Attempts have been made not only to define the psychological nature of the disorders but to deduce some satisfactory hypothesis of the physiological disorder. In a recent paper Ranschburg and Schill explain agnosic and alexic defects as the result of pathological narrowing of consciousness from a decrease and an abnormal distribution of energy.[77] They point out that there may be a functional reading disorder when the reading field is histologically unchanged. The simultaneous recognition of several letters, for example, may be impossible if the branches of the arteries in the reading field are narrow and so decrease the nourishment of the neurones. Momentary changes in interest, for another example, may result from sudden spurts in the blood stream.

Beringer and Stein attempted to explain the characteristic behavior of their patient in reading and agnosic functions as the result of differences in the excitability of the visual apparatus.[78] They found that she was more than normally dependent on the intensity and the size of the stimulus and that chronaxie was increased. Their work is an important contribution, and shows the type of detailed study which may be fruitful in the analyses of alexia and agnosia. Most reports have included more or less extensive studies of recognition, but they have lacked the intensive experimental work on visual perception which might throw light on the nature of the disorder. At the same time it must be remembered that many of the disturbances, even on the level of agnosia, are not to be catalogued simply from the point of view of their character as perceptual abnormalities; they are related to more complex disturbances of mental functioning and must in the end be considered with these.

---

[73] W. Poppelreuter, *Die psychischen Schadigungen durch Kopfschuss,* I, 1917.

[74] Wolpert, *Ueber das Wesen der literalen Alexie,* Msch. f. Psychiat. u. Neur., 1930, 75, 207–266.

[75] See page 44.

[76] F. Kramer, *Beitrag zur Lehre der Alexie und der amnestische Aphasie,* Msch. f. Psychiat. u. Neur., 1928, 68, 346–360.

[77] P. Ranschburg and E. Schill, *Ueber Alexie und Agnosie,* Zsch. f. d. ges. Neur. u. Psychiat., 1932, 139, 192–240.

Cortical sensory aphasia. The cortical sensory form, Wernicke's aphasia or Marie's "true" aphasia, is a complex disorder generally recognized to involve not only difficulties in the understanding of speech and in reading, but defects in speaking and writing as well.[79] The expressive defects usually take the form of paraphasia, paragrammatism, or difficulty in word-finding. Cases differ widely in the prominence of these expressive defects in relation to the difficulties of understanding, and also in the prominence of one of the expressive defects in relation to the others. It is further agreed that cortical sensory aphasia is often accompanied by general changes such as perseveration. The extent to which intelligence may be said to be affected is a moot point. Some investigators have held that intelligence suffers because speech is disturbed while others have held that speech is disturbed because of the intellectual disorder. The whole question has been confused, largely because of inadequate methods of testing and of poorly defined concepts of language and intelligence.

The most outstanding work on the whole problem of sensory aphasia with all its ramifications is that of Arnold Pick. He attempted to analyze the processes in speech understanding, noting the various interrelated factors: the perception of speech as different from the total acoustic impression; the recognition of words as phonetic unities and the correct understanding of the musical parts of speech; and the consciousness of meaning, with the *Vorkonstruktion* (Bühler) through which the words are brought into relation and given the proper emphasis.[80] Pick's work was of direct value in throwing light on the difficult problems of understanding and of great indirect value in emphasizing the complexity of the processes.

---

[78] K. Beringer and J. Stein, *Analyse eines Falles von "Reiner" Alexie,* Zsch. f. d. ges. Neur. u. Psychiat., 1930, 123, 472–478.

[79] It has usually been supposed that disturbances in both reading and writing were an essential part of the picture of complex sensory aphasia. Kleist believes that this form of disorder appeared in the War material without disturbances in reading or writing, and cites two cases, without, however, sufficiently detailed reports to settle the matter (1934).

Clinical experience shows that there are all degrees of difficulty in understanding and that there is no regular relation between the correct appreciation of the sound and adequate comprehension; the one is frequently to be observed without the other. It has become increasingly evident that there is no absolute limitation to the understanding, but rather wide fluctuations according to the nature of the situation and the patient's condition. A further interesting variation is to be found in the patient's appreciation of his difficulty, a problem which has been discussed recently by Bonvicini.[81]

The localization of cortical sensory aphasia is considered to be, roughly, the Wernicke area, the posterior part of the first temporal convolution together with the neighboring part of Heschl's convolution, the parietal lobe, and the posterior section of the Island. The significance of the areas around the posterior part of the first temporal convolution is not determined and is probably variable.

The disturbances in understanding are often only a small part of the cortical sensory aphasia. Indeed, other disturbances are sometimes so marked that many investigators object to the use of the terms "sensory" or "receptive" to describe the picture. These other disturbances may be considered in two groups: first, the expressive changes and, second, the more general changes such as perseveration and the various signs of intellectual deterioration.

Before discussing the characteristic expressive changes, it must be noted that while the speech of the motor aphasic is generally retarded and scanty, that of the sensory aphasic is usually either normal in speed or accelerated, and it is not limited in amount. The rapid tempo has sometimes been cited to explain the errors in words or sentence structure which the sensory aphasic makes, but it has never been a sufficient explanation.

The most prominent changes in expression characteristic of the sensory aphasic may be divided into three groups: the confusions in words which constitute paraphasia, the errors in grammatical forms and word-order which constitute paragrammatism, and the disturbed word-finding. Paraphasic changes appear both in the structure of the word and in the use of words. In the first instance the errors are of the "literal" type, and the confusion in letters and their order within the word may be so great that the word is badly garbled and perhaps unrecognizable.[82] Severe literal paraphasia results in a gross speech disturbance which has been called "jargon aphasia." The second type of error, with the word confusions, represents the "verbal" paraphasia. Analysis of these word confusions is particularly interesting; it often shows that the word substituted for the correct word bears some relation to it or is within the same "sphere." The patient may say, for example, that the "lawyer" sent him into the hospital when he means that the doctor sent him. Naturally literal and verbal paraphasia are not independent types of disturbance. Both kinds of defect appear in all cases, but the one may be far more prominent than the other.

---

[80] Pick, *op. cit.,* 1434–1436.

[81] Bonvicini, *op. cit.,* 1719–1732.

The question of paragrammatism has already been touched on in connection with agrammatism and the cortical form of motor aphasia. It has been said that paragrammatism is characterized by confusions of grammatical forms, of auxiliaries, pronouns, prepositions, and so forth, and by changes in word-order. A consideration of the nature and extent of these errors makes it evident that they are not simply the result of word-substitutions, and consequently not like the paraphasic errors. They involve a more extensive change which shows uncertainty, not so much in the choice of words, as in the grammatical and formal aspects of the sentence structure.

Many hypotheses have been constructed to explain paraphasic and paragrammatic errors. The problems were first, and are still to some extent, approached via the disturbances in understanding. Wernicke said that the errors in speaking appeared because the regulation of the motor speech functions by the sensory was disturbed through the destruction in the first temporal convolution and the consequent loss of sensory word-images. Goldstein has well said that

[82] Literal paraphasic errors result in changes in the structure of the word which are like the word-misformations so frequent in the speech or writing of the cortical motor aphasic. Head attempted to differentiate between the misformed words which characterized verbal aphasia and those appearing in nominal, saying that the former "usually correspond more or less closely to the correct name, although enunciation may be so faulty that the word is scarcely recognizable." (*Op. cit.,* 302.) He believed that the nominal errors, while they might show defective word-structure, were nevertheless more typically confusions in the use of words as names. It is true that the majority of the errors in the type Head called nominal and in the sensory type discussed here are *verbal* confusions, but literal errors do appear also, and they cannot well be distinguished from the errors in word-form made by the verbal or motor aphasic.

this explanation would fail because acoustic *Gestalten* are not necessary for normal speech, nor is control of the motor side through the sensory possible for that control would come too late.[83] Kussmaul differed from Wernicke and sought to explain the errors in speaking as the result of disturbances in attention, which he attributed to general disorders in cerebral circulation and so forth. Piéron has recently attributed paraphasic errors to imperfect control of the sensory over the motor, but he understands this sensory control to include both acoustic and kinaesthetic factors.[84]

Pick considered that incorrect division of attention might play a role, and noted that distractions frequently caused errors of the paraphasic type in normal persons.[85] At the same time he recognized that attention to the speech product often increased the paraphasia. He believed that factors such as attention or rate of speech were probably of secondary importance, and that the essential cause for the disturbances would appear only through analysis of the thought-speech process. He was the first to attempt to pool the results of many different attacks on the problem of inner speech, and to interpret the pathological findings in terms of psychological and philological data.

Pick's analysis of the course from thought to speech has been accepted in essence by Van Woerkom and many others.[86] While it is evident that the stages of intuitive thought, thought with increasingly greater structure, sentence schema, and word choice, are neither distinct in time nor invariably parts of the total process, there is general agreement that the typical verbal formulation, whether expressed or not, is preceded by a process where thought becomes ordered and falls into a structure which will admit of verbal expression.[87] This is roughly the process Jackson defined as the subject-proposition. Arising from it is the actual language formulation. This does not, however, represent a simple transposition of thought order into speech order. It evolves under the influence of a number of factors which differ in different languages, rhythm, accent, feeling for phrasing and for grammatical forms, and it takes on a different character according to the nature of the situation in which the speaker finds himself.[88]

[83] Goldstein, *Die zwei Formen der Störungsmöglichkeit der Sprache durch Hirnschädigung,* Arch. f. Psychiat. u. Nervenkh., 1931, 95, 738–739.

[84] H. Piéron, *Thought and the Brain,* 1927, 194.

[85] Pick, *op. cit.,* 1455–1456.

[86] See page 42, footnote 34, and page 51.

[87] Goldstein speaks of the thought order at this pre-language stage as the "Grammatik des Denkens." It is an order dependent upon the position of the members in the structure while the speech order is a syntactical one, dependent not only upon placing but upon differences in forms.

[88] The problems of inner speech have been particularly difficult because the phrase has had so many meanings, but it is not possible to simplify the problem by simplifying the definition. The concept of inner speech as speech which is not articulated, a definition given by Jackson and accepted by Head, simply relegates the crucial problems to earlier stages in the thought-speech process. The difficulties and the interest of the problem of inner speech lie in the process of language formulation and in the differences between the beginning speech formulations and the final expression.

Pick attributed the expressive errors in question to defects at different stages of the course from thought to speech. He expressed the essential nature of the defects as lack of inhibition (*Enthemmung*). Thus paragrammatic errors result from defects in the formation of the sentence schema. Verbal paraphasia occurs when there is a defect in the stage of word choice. Normally, intention is directed toward the word determined by the thought or by the sentence schema; but in verbal paraphasia the rigid determination of the correct word is disturbed and the thought processes or words arising by association, which are usually inhibited, now pass directly over into the motor speech apparatus. In the case of literal paraphasia the difficulty also arises from lack of inhibition, but in the building of words rather than in their choice.

Goldstein has treated the problems of verbal and grammatical errors at great length as manifestations of a speech disturbance which may appear in connection with the cortical forms of motor or sensory aphasia, or which may appear alone as "conduction" or, in his term, "central" aphasia.[89] Differing as he does from Pick in his basic concept of the disorder, Goldstein attributes the errors not to a lack of inhibition but to the difficulty the patient experiences with the round-about methods he must use for speech expression when the normal methods are disturbed, and ultimately to his inability to achieve normal figure-ground formations. Goldstein does not present a detailed analysis of the course from thought to speech as Pick did, but he finds the disturbances in the same part of the course, that is, in the transition from the thought order to the speech order and in the processes of the speech formulation. He stresses the point here that the errors in question are the result of a speech disturbance. (The term speech is used in the broad sense of "language.") The defect is to be distinguished from a thought disturbance *per se,* which Pick also denied for these types of error, and also from a disorder of the symbolic function.[90] It is true, as Goldstein noted, that paraphasia and paragrammatism are not symbolic disorders, for the confused words and grammatical forms may have a good part of the symbolic value of those which would be correct.

The third type of expressive defect which is likely to be present in cortical sensory aphasia is the difficulty in finding words. This is a disturbance which is usually more prominent in sensory than in motor aphasia, and which may appear independently of either, in the form discussed below as amnesic aphasia.[91] Patients who show this amnesic difficulty hesitate in speaking because they cannot find the proper word and have great difficulty in naming objects. The patient with a relatively clear-cut amnesic aphasia usually recognizes the correct word when he hears it, but the cortical sensory aphasic, with difficulty in word-finding as part of the picture, often does not.

---

[89] See pages 76–78.

[90] Neither Goldstein nor Pick means that errors in speech never depend on a thought disturbance, but that the particular errors in question here do not.

[91] See pages 78–82.

In addition to the expressive changes of cortical sensory aphasia, there are other general characteristics to be considered. It is common to find perseveration in this form of disorder, and Pick and others have noted that it is especially characteristic of paraphasia. A word which may be correct on its first use reappears again when it is not suitable. Through its persistence it may "contaminate" some new word, and thus lead to a different type of error. Letters, turns of phrase, or sentence structures may perseverate similarly. It is far simpler to describe this disorder than to explain its basis. Observations have shown that it becomes more pronounced when the patient is attempting something which is difficult for him or when he is fatigued. Pick suggested the accelerated speech of the sensory aphasic as one factor leading to perseveration and the lack of inhibition in word choice as another.[92] On the question of localization, he noted that lesions had usually been found on the left side in right-handed persons. While perseveration was often marked with lesions of the temporal lobe, he did not believe that it appeared only with these.

Goldstein holds a general view with regard to perseveration which is well supported among psychologists, namely, that the patient perseverates because he cannot make the quick changes in attitude which the shift from one performance to another necessitates. He expresses the condition in *Gestalt* terminology, saying that once a figure arises and is sharply differentiated from the ground, it may have an abnormal stability because the many other stimuli which would normally give rise to other figure-ground formations and so break down the first, do not operate because the whole system is deteriorated.[93]

The question of a general intellectual defect in cortical sensory aphasia has been argued pro and con for many years and has been particularly difficult to settle because the receptive disturbances masked whatever intellectual changes might exist. There are still investigators who believe that the receptive disturbances are actually responsible for the apparent intellectual defect, and others who think the opposite relationship is the true one. Marie's concept of a general intellectual defect and a special language defect in every case of true or Wernicke aphasia was not clear enough nor well enough supported by clinical facts to be generally accepted. One of his great difficulties was that he lacked sufficient tests to investigate intelligent behavior outside of the language field. Until "non-language" tests were introduced, no one could determine the relative efficiency of behavior in verbal and non-verbal problems. Non-language tests have not yet been used in sufficient variety, nor have they been employed for enough cases.[94] These tests are, of course, equally important for other types of aphasia besides the sensory. The problem is to determine the quality of behavior in non-verbal situations; and then in verbal situations which bring out different language processes. From facts of this kind conclusions can be drawn not only as to the nature of the language disturbances, but as to their severity in relation to the changes in non-language performances, and consequently as to the presence of a general intellectual disorder or of more specialized changes along certain lines.

---

[92] Pick, *op. cit.*, 1461.

[93] Goldstein, *Die Lokalisation in der Grosshirnrinde,* Handb. der norm. u. pathol. Physiol., 1927, 10, 679.

Two further forms of disorder have been differentiated and said by some authors to be independent of cortical sensory aphasia. One of these, the transcortical sensory, is now commonly considered a subordinate form of the cortical sensory. About the other, conduction aphasia, there is more dispute but the weight of evidence goes to show that it, too, may be regarded as subordinate to the cortical sensory disorder.

The *transcortical form* was defined by Lichtheim on the basis of his diagrammatic conception of aphasic disorders and said to be characterized by loss of understanding when the patient could still repeat and write to dictation. A number of patients have since been reported whose understanding was more seriously affected than their ability to repeat, but in the opinion of many authors they either fall in the general group of cortical sensory aphasia, or in certain types of mental disorder showing the condition defined by Pick as "echolalia." Goldstein believes that the aphasic form can occur as a result of slighter injury of the Wernicke area, a stage in the recovery from cortical sensory aphasia, or if the injury is severe, as a result of the functioning of the opposite hemisphere.

Conduction aphasia has had a stormy history. First postulated by Wernicke as the form of disorder which would appear when a lesion disturbed the connection between sensory and motor speech centers, it was rejected by many investigators. Others gave different explanations for the disorder but granted that it did exist and was characterized by severe disturbances in speaking, repeating, and reading, together with relatively slight limitations in understanding. In other words, the patients showed the expressive defects of cortical sensory aphasia, the results of disturbed inner speech processes, but not the severe limitations in understanding. Review of the cases shows that even the purest manifested some defect in understanding.[95] In spite of this defect the syndrome has been said to be independent of cortical sensory aphasia because of the disproportion between the disturbance in repetition and the limitation in understanding. Furthermore, an attempt has been made to differentiate between the nature of the disturbance in understanding as it appears in conduction aphasia and in sensory aphasia. In recent papers Schaffer and Hilpert each report cases where there was supposed to be no word-deafness, but a difficulty in understanding.[96] Hilpert says that the patient perceives the word but does not understand it, and that the disturbance is on a higher speech level than that of sensory aphasia. A broad survey of the cases in the literature seems to indicate that neither the relatively slight disturbance in understanding in comparison to other language difficulties, nor the different type of disturbance in understanding is a sufficient criterion for setting conduction aphasia apart as independent of the sensory disorder. The sensory form represents a very large group of disturbances, whether or not conduction aphasia is excluded from it. It includes expressive as well as receptive changes, and furthermore the so-called receptive changes involve not only difficulties in the perception of spoken or printed words but limitations in the understanding of meaning which do not always run parallel to the strictly receptive defects. There are many combinations of disturbances which fall under the convenient but inexact heading of sensory aphasia, and many differences in the degree of one disturbance in relation to another. No absolute divisions can be made within the large group, however; the cases are rather to be placed in various series according to one characteristic or another, than to be assigned to mutually distinct classes.

---

[94] Up to this time the non-language tests which have been most frequently used are drawing tests. The interesting results of these tests through many years should have led to their more extensive use and to the introduction of related tests. The question of drawing in sensory aphasia has recently been discussed by Bonvicini (*op. cit.*, 1735–1746). Further consideration of the drawing and other non-language tests which have been used for cases reported in the literature appears in the section on apraxia and agnosia in Chapter IV.

---

[95] The following cases, for example, have been said to be among the "purest":

Stertz (1914). Man of 52. At first difficulty in speaking, understanding, and writing and also apraxic disturbances. During third week after attack, understanding improved so much that patient could carry out complicated commands (threefold directions) and give the point of a short story. At the same time his understanding was not normal for he continued to have difficulty in following the conversation of a third person.

Isserlin (1920). Man of 25 with traumatic injury of left temporo-parietal area. Disturbance in spontaneous speech, pronounced disturbance in repetition, and much less marked change in speech understanding.

Grubel (1926). Woman of 44. Speech and writing severely disturbed; repetition severely disturbed with no improvement; understanding of speech and reading only slightly disturbed.

In a very interesting recent paper Klein (1931) also concludes that all cases of conduction aphasia would on thorough examination show some disturbance in understanding. This is true of a recent and well-studied case reported by Stengel, where understanding was sufficient for the patient to carry out threefold directions but not sufficient for her to understand the conversation of a third person, or longer stories or jokes (1933). Stengel, however, thinks conduction aphasia an independent type, and not a stage or form of cortical sensory aphasia.

[96] K. Schaffer, *Beitrag zur Insel-Linsenkernaphasie,* J. f. Psychol. u. Neur., 1930, 40, 180–189.

P. Hilpert, *Die Bedeutung des linken Parietallappens für das Sprechen,* J. f. Psychol. u. Neur., 1930, 40, 225–255; *Aphatische Storungen bei Prozessen im Bereich des linken Gyrus supramarginalis,* Arch. f. Psychiat. u. Nervenkh., 1931, 95, 743–747.

As to the particular localization of conduction aphasia, Wernicke supposed that the sensory and motor speech centers were separated by a lesion in the Island, and Goldstein, who has done a great deal of work on this form of disorder ("central" aphasia), also says that the lesion lies in the field between the motor and sensory speech regions, involving the Island and the bordering parts of the temporal lobe, the central convolutions, and the frontal lobe. Most investigators who think conduction aphasia an independent disorder agree with this localization but Hilpert concluded from his recent case that the lesion lay in the supramarginal gyrus, disturbing the connections between memory images from the different sensory fields. A further point of interest with regard to localization is the opinion of those who find conduction aphasia a subordinate form of sensory aphasia and sometimes appearing in the recovery from sensory aphasia; and who then assume that the relatively satisfactory understanding in conduction aphasia results from activity of the right hemisphere, either because the right as well as the left is normally active in speech understanding and only the left in motor speech, or because after the injury the right can take over the function of speech understanding but not of motor speech.

AMNESIC APHASIA

Goldstein, Pick, Heilbronner, and many others have recognized amnesic aphasia as an independent syndrome, and the weight of evidence seems to support their view.[97] A number of cases have been described where there was a marked difficulty in finding words as names when words and phrases in certain uses could be evoked more easily and when other language processes remained relatively undisturbed. The typical patient hesitates for words in speaking, and is often unable to name an object, but he articulates words well and understands fairly well.

The earlier controversies as to the existence of amnesic aphasia as an independent syndrome have given way to a more interesting matter, the nature of the amnesic disorder. The main characteristic, the difficulty in finding words as names, is admitted, but the basis for this difficulty and the extent to which the disorder goes beyond it are still subjects of debate. Goldstein has taken a definite stand on the subject, which has been disputed by Isserlin (1927), Von Kuenburg (1930), Hauptmann (1931), Schaffer (1933), and Lotmar (1933).

---

[97] Wernicke believed amnesic aphasia a form of transcortical motor aphasia and Dejerine thought it a less severe form of either sensory or motor aphasia.

In Goldstein's opinion amnesic aphasia is the purest form of disorder of propositional speech, but it is more than a speech disturbance; it involves a fundamental change in behavior of such a nature that any "categorical" action is disturbed.[98] The patient's responses have sunk to a lower functional level; they are more primitive and more concrete than the normal. One manifestation of this change is the difficulty in finding words as representations of something or symbols, when the patient can still produce them in automatic word series and other inferior speech responses. Another manifestation is his difficulty in classifying, that is, in arranging objects in groups according to some higher category such as their function, or colors according to their hue. Goldstein and Gelb have studied color-sorting in patients of this type with particular interest.[99] They believe that the patient's arrangement of colors is more concrete and more primitive because he lacks the ability to maintain some "principle of classification."[100]

Isserlin and Von Kuenburg do not agree: they find, first, that a number of cases of brain injuries with difficulty in word-finding show "categorical" behavior in classification experiments, and, second, that some normal persons show concrete or more primitive behavior.[101] In 1930 Von Kuenburg reported classification experiments with normal adults of elementary and high-school training, children, deaf-mutes, and aphasic patients.[102] She used twenty-two objects which could be classified in different groups and the Holmgren wools, and gave each subject the idea that he could classify in any way which seemed right to him. The results showed clearly that there was no one normal principle of classification. Some normal subjects classified on a logical basis, others on a perceptual or on an aesthetic basis. Some of the deaf-mutes made logical arrangements, but many seemed to be prevented from doing so because of lack of words. Similarly among the aphasics, the limitations in classification seemed to arise from lack of words rather than disturbance in thought. The results are conclusive evidence of individual variability among normals, and show that Goldstein cannot assume a categorical principle of classification as the standard. Furthermore, they indicate that the classifications made by the deaf-mutes and aphasic patients are abnormal rather because of poverty of words than because of lack of a guiding principle. At the same time the study does not undermine Goldstein's position on the nature of the classifications amnesic patients make, for Von Kuenburg's cases were complicated motor or sensory types from which conclusions about clear-cut amnesic aphasia cannot safely be drawn.

---

[98] Goldstein, *op. cit.*, 792–795.

[99] Goldstein, *Ueber den Einfluss von Sprachstörungen auf das Verhalten gegenüber Farben*, Dtsch. Zsch. f. Nervenhk., 1922, 74, 260–262; Gelb and Goldstein, *Ueber Farbennamenamnesie*, Psychol. Analysen hirnpathol. Fälle, X, Psychol. Forsch., 1924, 6, 127–186; Goldstein, *Das Wesen der amnestischen Aphasie*, Schweiz. Arch. f. Neur. u. Psychiat., 1924, 15, 163–175.

[100] It is to be noted that the difficulty in sorting colors is not thought to depend on the difficulty in finding words; both are the manifestations of the fundamental disturbance in categorical behavior. Goldstein and Gelb admit that the speech disorder is so marked that the lack of a principle of classification might seem to result from it, but point out that there are patients who cannot classify normally when they hear the right name, or when they themselves repeat it correctly. They fail because the name in such instances is only a "hollow shell"; it is no longer a representation, but a part of concrete experience. In so far, then, the patient has sunk to a more primitive and more childish level. Actually, however, Goldstein and Gelb find that the speech of the amnesic aphasic is less sufficient than that of the child, especially in concrete words, and his use of words is different from the child's. For the child the word has a very close connection with the object. For the adult this close connection has gradually disappeared and the word has come to be a name. When, in consequence of amnesic aphasia, words can no longer be evoked as names, the adult's speech is even less adequate than the child's because he has lost the habit of using words in the more primitive, direct connection with the situation.

Another attack on Goldstein's conception of amnesic aphasia has been made by Lotmar, whose work has already been mentioned.[103] Approaching the problem from a different angle than Isserlin did, Lotmar has come to the same conclusion about the importance of the speech disturbance. He has analyzed the difficulty in word-finding directly, through experiments of the type Selz used in studying language and thought. The results, in Lotmar's opinion, do not indicate a primary thought disorder but a speech disturbance, an inhibition preventing the normal production of words. From his naming experiments he quotes frequent examples showing that the patient understood the use or nature of the object he saw without being able to name it directly. Sometimes he arrived at the correct name after paraphrasing or using a related word. Sometimes he would say, "That is a . . .," and hesitate for some time before being able to produce the name. Sometimes he would get only part of the word and be slow in bringing out the final syllables; or his response would be disturbed by perseverations. In Lotmar's opinion none of these characteristics of the responses showed a loss of categorical behavior; rather were they similar to the difficulties a normal person experiences in seeking for a name. The records are undoubtedly sufficient to prove that the primary disorder in the patients studied was one of speech and not of thought. It must be noted, however, that the eleven patients of the group were cases of complicated motor or sensory aphasia, all showing pronounced disorders in word-finding but none showing clear-cut amnesic aphasia. The problem is complicated by the many different points of view on classification. Goldstein believes in a distinct type of amnesic aphasia and, while it may seem justifiable to infer that all difficulties in word-findings are alike whether they occur in motor or sensory or amnesic types of disorder, cases of the clear-cut amnesic aphasia should be used to check his views.

---

[101] Isserlin, Von Kuenburg, and Hofbauer, *Zur Pathologie der Beziehungen zwischen Sprechen und Denken*, Zbl. f. d. ges. Neur. u. Psychiat., 1927, 47, 252–254.

[102] Von Kuenburg, *Zuordnungsversuche bei Gesunden und Sprachgestörten*, Arch. f. d. ges. Psychol., 1930, 76, 257–352.

[103] The most recent report is *Zur Pathophysiologie der erschwerten Wortfindung bei Aphasischen*, Schweiz. Arch. f. Neur., 1933, 30, 86–158 and 322–379.

With regard to the localization of amnesic aphasia Goldstein has written that the loss of categorical behavior indicates the disorder of a higher brain function, and that this disorder results from a diffuse cerebral lesion. He thinks that there is no gross destruction of the speech area with amnesic aphasia, but rather a slight general cerebral disturbance or a focus between the parietal and temporal lobes, most likely a tumor, which upsets the whole function without destroying it in parts.[104]

Goldstein's opinion on localization and on the disturbance of a fundamental brain function has also been contested in the recent literature. As stated by Hauptmann and other critics the situation is this: cases of extensive cortical lesion are unsuited for the study of amnesic aphasia because the extensive lesions may well lead to various general mental changes.[105] Among these is sometimes the disturbance of categorical behavior, which is better considered with the general mental changes than with the language disorder. The best cases for the study of amnesic aphasia are cases of tumor in the temporo-parietal area, and these, contrary to Goldstein's belief, are thought to show no change in categorical behavior other than that resulting from the loss of words.

---

[104] The above statements on localization apply only to the true amnesic aphasia which Goldstein differentiates, and not to the difficulties in word-finding which appear with other forms of disorder.

[105] A. Hauptmann, *Ist die amnestische Aphasie Teilerscheinung einer Beeinträchtigung des "kategorialen" Verhaltens?* Msch. f. Psychiat. u. Neur., 1931, 79, 302–313.

In discussing otitic temporal lobe abscesses, Bonvicini notes that word amnesia is often a marked symptom and that a true sensory aphasia is likely to appear only after the abscess has spread considerably.[106] This type of amnesic syndrome is not that which forms the basis of Goldstein's discussion, but it is apparently a true form of amnesic aphasia.

---

[106] Bonvicini, *op. cit.,* 1821–1828.

IV

THE HISTORY OF APHASIA: SPECIAL PROBLEMS

1. Tests and Examination Methods
    - Early studies
    - Methods used in Germany during and after the War
    - Head's tests for aphasia
    - Summary
2. Improvement and Reeducation
    - The processes underlying improvement
    - Reeducation
3. Apraxia and Agnosia
    - Early views and modern methods of study
    - Principal types of apraxia and agnosia as they are usually differentiated
    - The present status of the work on apraxia and agnosia
4. Amusia

1. TESTS AND EXAMINATION METHODS

Early Studies

IN the early days aphasic disturbances were determined largely by observation of the patient in natural situations, but to analyze such functions as speech understanding or repetition the investigator always had to introduce what was in essence a test situation. He would, for example, ask the patient to hold up the proper number of fingers to indicate how many weeks he had spent in the hospital. From time to time a specific test for some performance often disturbed in aphasia would be recommended and put into fairly general use. Of these isolated tests probably the best known was the Proust-Lichtheim, an attempt to investigate inner speech by having the patient hold up as many fingers as there were syllables in the word he could not pronounce.

As early as 1888 Rieger, professor of psychiatry at Würzburg, constructed a true battery of tests for the study of an aphasic patient, but few investigators made use of his method or attempted any comprehensive survey of aphasic disturbances by such objective test methods.[1] Marie's list of tests, as reported by Moutier in 1908, was more extensive than any yet outlined, but was rather a collection of all the tests earlier proposed plus those Marie himself devised than a systematic arrangement of tests which would cover all significant performances, but without duplication.[2]

---

[1] C. Rieger, *Beschreibung der Intelligenzstörungen in Folge einer Hirnverletzung,* 1888, 5–70.

Methods Used in Germany during and after the War

By 1914, however, great advances had been made in the development of psychological tests and the construction of test batteries, so that there was a large amount of material available to those faced with the problem of studying the psychological disturbances resulting from head injuries received in the War. The greatest amount of significant work on aphasia was done in Germany, where many institutes were established to care for patients with head injuries and, if possible, to rehabilitate them so that they could be returned to a useful occupation. At some institutes patients were studied by the old observational methods, but at others they received systematic psychological examinations, based on the "mental tests" which had already proved useful in estimating intelligence, largely among school populations. It is significant that these psychological examinations were not introduced simply for the study of aphasic patients; the earliest were arranged for patients with all types of brain injuries and sometimes for the neurotic and feebleminded as well.[3] They proved useful in the analysis of aphasia and related disorders, and were therefore continued and developed further for this specific purpose.

Two of the most productive institutes were headed by Goldstein and by Poppelreuter, one at Frankfurt and the other at Cologne. These two investigators both used and developed psychological techniques, but their methods and interests differed considerably. Goldstein had worked on aphasia for many years and had come to believe that study of the patient's response was futile unless based on exact knowledge of the situation from which it arose and of the manner in which it arose. He attempted to make his examination a coherent whole rather than a series of separate tests. He planned first a general examination which would indicate the disturbance roughly, and then special studies to be chosen according to the findings of the preliminary examination, and to provide for analysis of the extent of the disturbance and the nature of the compensation which the patient had achieved.[4] In view of his belief that the response varied according to the nature of the situation from which it developed, he arranged for two types of tests in his examination, the "abstract" or laboratory studies, and the "concrete" studies or those based on work under natural life conditions. Poppelreuter did not agree with Goldstein altogether on this point, and his interest in the qualitative study of performance was somewhat different. He believed that the abnormal achieved a response similar to the normal but required more time to do so, while Goldstein thought that the abnormal response was likely to be altogether different in its development from the normal. Poppelreuter attempted to determine the normal range in various performances, but was at this time unable to do so because the individuals he studied were not really normal; for a variety of reasons they were unfit for military service.[5]

---

[2] Moutier, *op. cit.*, 375–383.

[3] J. Dürk, *Die Experimentelle Psychologie im Dienste der Wieder-Ertüchtigung Gehirnverletzter,* Zsch. f. angew. Psychol., 1918, 13, 140–146; W. Peters, *Psychologie und Hirnverletztenfürsorge,* same journal, 1918, 14, 75–89.

The particular tests which Goldstein and Poppelreuter used were selected from the available psychological tests of intellectual ability and of various special abilities, educational achievements, and vocational aptitudes. In general these two investigators placed most emphasis on tests of physical work-capacity, of visual perception and recognition, and of reading, writing, and arithmetic.[6] They used few tests of higher mental processes in the language field, and very few tests of "non-language" intelligence, that is, performance tests which depended on intellectual ability rather than physical work-capacity.[7] Indeed, it is only since the period of the War that the so-called non-language intelligence tests have been developed in any number and variety.

---

[4] Goldstein, *Die Behandlung, Fürsorge und Begutachtung der Hirnverletzten,* 1919, see especially 22–29. For discussion of Goldstein's methods, see W. Benary, *Zur Frage der Methoden psychologischer Intelligenz- und Eignungsprüfungen,* Zsch. f. angew. Psychol., 1920, 17, 110–133.

[5] Poppelreuter, *Die psychischen Schädigungen durch Kopfschuss,* 2 vols., 1917 and 1918.

[6] The emphasis on physical work-capacity was a natural result of the need to determine what type of work the patient could be given and how soon he could be started on it. The necessity for getting the patients back to work or to military service probably had a double effect: it forced these investigators to determine for each patient the type of work he could do best and the methods by which he could be reeducated, but it also had the effect of turning their attention from studies of "higher mental processes" which were at the time of less practical significance.

Poppelreuter's most important special studies were of visual disabilities resulting from brain injuries. For his work on agnosia, see page 102.

[7] Poppelreuter used various tests of visual perception and a classification test which are to be grouped as non-language intelligence tests. Benary, in his study of the case of psychic blindness previously investigated by Goldstein and Gelb, tested the perception and recogni-

Head's Tests for Aphasia

Strictly psychological tests for the study of aphasia have been adopted more widely in Germany than in any other country, but other types of examinations have been developed elsewhere. In Holland, Van Woerkom devised a number of special tests to determine performances in spatial orientation and construction which he believed to be seriously disturbed in aphasia.[8] In England, Head constructed a different type of battery, based on his theory that the fundamental disorder in aphasia was one of "symbolic formulation and expression" and emphasizing above all else a systematic examination.[9]

Head's tests merit particular attention: they were specifically designed for the study of aphasia and presented as an adequate system for the determination of aphasic disorders. They are made up of the so-called "serial tests" supplemented by various suggested studies of a less formal nature, but requiring equally systematic procedure. The serial tests each include a number of different tasks designed to trace the central disorder of symbolic formulation and expression through its various manifestations in speaking, reading, writing, and so forth.

Thus in the first test, the naming of common objects, the patient is required to name the object orally; to select it when the name is given, first orally and then in print; to repeat the name; to write it and to copy it. Each part of the serial test includes the same number of items, presented in the same order. Each item is repeated two or more times. The object-naming test, for example, is based on six familiar objects, each of which is presented two or more times but always in the same definite order, for the patient to name, to identify at oral or printed command, and so forth.

The other serial tests are: the naming of colors, a test arranged much as the object-naming test is arranged; the "man, cat, and dog" tests, which are easy reading tests; the clock tests, involving setting the hands of the clock and tell-

---

tion of figures and the arrangement of a picture series like those used by Stern and Wiegmann. (Benary, *Studien zur Untersuchung der Intelligenz bei einem Fall von Seelenblindheit,* Psychol. Forsch., 1922, 2, 209–297.)

[8] Van Woerkom, *La signification de certains éléments de l'intelligence dans la genèse des troubles aphasiques,* J. de Psychol., 1921, 18, 730–751.

[9] Head, *Aphasia and Kindred Disorders of Speech,* I, 145–165; and *An Historical Review* (the Hughlings Jackson Lecture for 1920), Proc. Roy. Soc. Med., Sect. of Neur., 1920–1921, 14, 1–22; discussion 29–38.

ing time; the "coin-bowl" tests requiring the following of directions of numerical and spatial nature; and the "hand, ear, and eye" tests involving the following of directions and the imitation of movements. These tests, together with the more informal supplementary studies Head described, cover the following performances: matching objects or colors; imitating the setting of a clock or movements of the hand to eye or ear; drawing from model or from memory; following oral or printed directions; "series speech"; repetition; naming; describing or interpreting pictures; reading, writing, and arithmetic.

The tests must be considered from several points of view: first, their arrangement; second, their content and the factors depending on the performances which the tests involve; and finally, their adequacy in differentiating between the aphasic and the normal.

1. *Arrangement of the tests.* In constructing the tests, Head planned to take into account three definite factors which his earlier sensory studies of patients with brain injuries had shown to be important. The first of these was the possible variability in response from one presentation of an item to another; the second, the influence on the response of the position of the particular item in the list; and the third, differences in the severity of the disturbances shown by different patients. Head was far more successful in providing for the first two factors than in providing for the third. By repeating each item two or more times, he arrived at a fairly just estimate of the patient's average performance and discounted to some extent the effect of variability. By arranging the items in a definite order and holding to this order from one part of the serial test to another, he was able to eliminate variations of another nature. There can be no doubt that the response may be influenced by that which has just preceded it, and Head was on firm ground in insisting that the oral responses could not be compared, for example, with the written, if items in the two parts of the series had been presented in different order.

The third factor which Head had in mind, differences in the severity of the disturbances, is naturally of tremendous importance, but his tests are not satisfactory from this point of view. They do not present a number of tasks graded from easy to difficult, and adapted to show how far the patient can go in reading, writing, and so forth. In many types of performance the tests are not sufficiently difficult to indicate slighter disturbances. It is true that some types of performance, such as following directions, are tested in situations of different difficulty, but these situations vary in nature so that the whole problem changes, and there is no true gradation of difficulty within any one type of problem. The patient has to follow instructions when he points to a stated object or color, when he sets the hands of the clock, when he puts a coin in a certain bowl, and when he puts the right or left hand to the stated ear or eye. If he succeeds in pointing to the correct object or color, but fails to carry out any of the other directions, it cannot be said that he follows simple but not complex commands, for the complex commands introduced new factors, such as spatial orientation, which changed the nature of the problem altogether. This point leads directly to the next problem in analyzing the tests, the evaluation of the content and the performances which the tests involve.

2. *Content of the tests.* The use of Head's tests with aphasic patients quickly shows some of them to be of far greater value than others. The most useful are undoubtedly the Object- and Color-Naming Tests; they are well-arranged examinations for performances which are of greatest significance in the study of aphasia. In addition, because of the "series" of attacks on the problem of naming, they show any fairly severe difficulty the patient experiences in speaking, understanding, reading, or writing. The Man, Cat, and Dog Reading Test is, as Head pointed out, very easy; actually it does not amount to much more than the identification of single words, and this has already been indicated by the Object- and Color-Naming Tests. For analysis of slighter reading disturbances, the investigator must supplement the routine tests by such informal studies as Head suggests. Indeed, the records of reading, writing, arithmetic, and drawing which Head obtained in addition to the results of the formal tests often indicated more important conditions than did the serial tests themselves. It was chiefly through these supplementary studies, for instance in the abstracting of printed passages or the interpreting of pictures, that Head approached the so-called higher mental processes. His battery includes some simple non-verbal performances which he believed to be unaffected in aphasia, other more complex performances requiring no verbal response, and many depending on various forms of language expression or reception. It includes few studies of higher forms of intelligent response either in the language or the non-language field.

Head's more complicated tests, the Clock, the Coin-bowl, and the Hand, Ear, and Eye, undoubtedly call for complex processes, but probably not those indicating higher levels in the development of intelligence. The chief difficulty with these tests lies in their interpretation; when the patient fails, the reason for his failure is largely a matter of speculation. The difficulty is particularly serious in the Hand, Ear, and Eye Test, which is perhaps the most original of Head's test arrangements, and which has aroused the greatest interest among students of aphasia. In one part of this test the patient is required to imitate the examiner who sits facing the patient and moves his right or left hand to either ear or eye; in another part to imitate the same series of motions when the examiner is sitting beside the patient and the movements are reflected in a mirror. Head found that the aphasic more often failed to imitate the movements made by an examiner sitting opposite than the movements reflected in a mirror. He explained this finding by saying that the imitation of movements made by someone facing the patient required some "internal verbalization," such as "opposite," which the aphasic because of his particular language disorder could not achieve.[10] Other investigators have applied the Hand, Ear, and Eye Test to aphasic patients, to children, and to normal adults and have found that there are several ways of imitating movements made by an examiner sitting opposite to the subject, some of which depend on verbal formulation and some on other processes, such as kinaesthetic cues.[11] Every study shows that individual differences are great. In any case, no one can attribute a failure in the test to defective verbal formulation without further analysis of the performance.

---

[10] Head, *Aphasia and Kindred Disorders of Speech,* I, 198–199.

The matter is of particular importance, not only for this one test but for tests in general. During the whole period of development of psychological examinations, tests have constantly had to be discarded because, while they undoubtedly tested something, no one could define the processes which were actually involved. Yet the problem is a little bit simpler, at least from the practical point of view, in work with normal than with abnormal persons. For the normals the results of tests may be of value providing they show a high correlation with some criterion such as academic success, even if the processes required in carrying through the test cannot be clearly defined. With abnormal patients such as the aphasics, the crux of the problem is the qualitative study of performance, and success or failure on any test is significant only in so far as the examiner can determine what processes were involved. In the study of aphasia, therefore, it is essential to work for tests which will give a clear-cut indication of the processes involved, either by limiting the types of response through which the test can be solved or by calling for a response which the examiner can observe in some detail. Undoubtedly such tests have not yet been developed in sufficient variety to cover the whole field of mental functioning, and temporarily at least every investigator has to employ tests which are not altogether satisfactory for the analysis of the processes involved. The essential requirement then is caution in interpreting the tests, and it is on this count that Head is open to adverse criticism. His conviction that aphasia was fundamentally a disorder of symbolic formulation and expression led him to interpret failures as defects in verbal formulation where these were not conclusively demonstrated by the test results.

On the subject of content there is one further point to be considered. Although some of Head's tests are difficult to analyze, it is nevertheless apparent that the battery involves considerable duplication. The facts already given will serve as an illustration. The following of directions is called for in a number of different situations, and this repetition would be justified only if the situations were so graded in difficulty as to determine how severe the disturbances in understanding were, or so varied as to constitute mutually distinct problems, requiring different types of understanding. Since the situations are neither sufficiently graded in difficulty nor sufficiently varied in type, the repetition is a waste of time. It is not a disadvantage theoretically, but a great disadvantage practically, for the objective of a satisfactory test battery must be all the brevity which is compatible with a comprehensive examination.

3. *Value of the tests in differentiating the aphasic from the normal.* The prob-

---

[11] F. Quadfasel, *Ein Beitrag zum motorischen Verhalten Aphasischer,* Msch. f. Psychiat. u. Neur., 1931, 80, 151–188; H. Gordon, *Hand and Ear Tests,* Brit. J. Psychol., Gen. Sec., 1922–1923, 13, 283–300; C. Fox, *Tests of Aphasia,* Brit. J. Psychol., Gen. Sec., 1931, 21, 242–255.

lem of evaluating the aphasic performance in terms of the normal has many ramifications. It is generally admitted that the aphasic patient fails in performances which are well within the range of normal persons, excluding of course those of extremely low-grade intelligence. The aphasic, for example, makes mistakes in articulating common words or is unable to produce familiar names; the normal never makes such errors except perhaps in cases of extreme fatigue or inattention. Those performances which show the aphasic to be distinctly below the normal ranges are naturally the simplest indices of aphasia, and for the most part it is on these which Head has concentrated in his serial tests. The patient must name objects or colors, understand directions presented orally or in print, and write words and phrases as any literate normal person could well do, providing he were above the lower classes of mental deficiency. Some of the performances Head included, however, notably parts of the Hand, Ear, and Eye Test, differ from these simple tasks. Instead of falling well within the range of any normal person, they are possible only for the more intelligent members of the normal group, or perhaps for the better educated. With increasing difficulty in the performance, there are proportionately fewer members of the so-called normal group who achieve it successfully. Furthermore, there are likely to be a greater number of methods by which a solution may be reached, and thus greater qualitative difference among members of the normal and of the aphasic groups as well as between groups. The simple procedure of eliminating from the aphasic battery all tests which are not well within normal ranges is not possible, for the aphasic disorders appear and are sometimes best demonstrated in performances which are good indices of intelligence.[12] The alternative then is to establish the typical normal performance and the range of performances on any test which is to be used with aphasic patients. Furthermore, in order to make just comparisons in any particular case, it is of course necessary to bear in mind the patient's educational and social level and the average levels of the normal group against which he is being judged.

Head was well aware of these facts and tried to meet the difficulties in two ways. In the first place, he made most of his studies on patients with head injuries received in the War, many of whom were commissioned men. As a group they were probably above the average in intelligence, and their failures on difficult tests were consequently more likely to be the effects of the pathological disorder, and less likely to result from lack of original ability. In the second place, Head did make some comparative studies of normal persons, for he frequently referred to the fact that the Hand, Ear, and Eye Test was the only one of the serial tests on which the normal person was likely to err.[13] He gave no data, but it is probable that he did not examine a sufficient number of comparable normal subjects to establish satisfactory norms for this test.

---

[12] Wilson in the *Discussion on Aphasia,* following Head's Hughlings Jackson Lecture, said that Head's tests seemed to be "tests of intellectual capacity, or at least of eupraxia, rather than of speech activity in the ordinary sense; in particular, his mirror test" (1920). Undoubtedly this comment is true, but speech activity cannot be measured independently of intellectual processes.

[13] Head, *op. cit.,* 148.

Furthermore, it is evident that Head did not establish norms for the supplementary tests: the alphabet, the abstracting of printed material, the describing of pictures, arithmetic computations, and drawing. For these tests as well as the serial tests, he emphasized systematic presentation, but, except for the alphabet tests, he varied the material somewhat to suit the individual patient. Actually this material should have been sufficiently standardized for some norms to have been obtained, for it includes almost all the more difficult tests of Head's battery, and consequently the tests which cannot be interpreted for aphasic patients without qualitative and quantitative knowledge of normal responses. The extent to which non-aphasic patients, some of them superior adults, may fail on various tests in Head's battery has been shown in the study by Pearson, Alpers, and Weisenburg.[14]

Analysis of Head's battery shows that it is to be commended highly for the systematic examinations which it enforces. Two of the tests included (the Object- and the Color-Naming Tests) are excellently arranged and should be a part of every aphasic study. The other tests are not so generally useful, partly because they do not provide in standardized form material for the determination of different degrees of disturbance, partly because they contain much unnecessary repetition, and partly because they are often difficult to interpret. As to their value in differentiating the aphasic from the normal, the simpler tests are satisfactory while the more difficult tests are not, for the latter require complex performances in which many normal persons are not altogether successful. These more difficult tests cannot be used satisfactorily with aphasic patients without knowledge of normal performances, both qualitative and quantitative, which Head did not obtain.

Summary

In summarizing the question of test and examination methods in aphasia, there are two important points to be emphasized. First, with regard to the development of tests and methods of study, it is evident that the construction of tests to supplement or replace observational methods, and the introduction of tests of the more complex mental processes have run parallel to the recognition of aphasia as a psychological problem and, furthermore, as a disorder extending far beyond simple speech processes. Second, with regard to the present status of the problem of testing, there has been an increasingly greater use and more skillful adaptation of available psychological techniques, but little uniformity in the tests employed. Progress toward uniform or comparable methods is not a simple matter. While many investigators would be willing to accept a certain number of fundamental tests in standardized form, they would disagree on others, and their disagreements would arise from different conceptions of the essential nature of aphasia. For example, Head, believing aphasia to be a disorder of symbolic formulation and expression, and Van Woerkom, believing it to be a disorder of spatial differentiation and construction, would never choose all of the same tests. On the one hand, tests are bound to differ as long as theoretical differences exist, and on the other hand, theoretical differences must exist and must even appear greater as long as the tests lack uniformity. Whatever the way out of the dilemma, it will undoubtedly be found through the study of large numbers of patients by comparable methods. Comparable examinations are being achieved to some extent in clinics or institutes where the procedures are fairly uniform, but aphasic patients differ so greatly that few investigators can obtain conclusive findings in individual clinical experience. The most practical solution to the testing problem, therefore, is to establish certain standardized tests which would demonstrate the most generally recognized disturbances, and to supplement these by tests developed in the light of particular hypotheses but in each case described so fully by the inventor that they could be interpreted or repeated by other investigators.

---

[14] Pearson, Alpers, and Weisenburg, *op. cit.*

2. IMPROVEMENT AND REEDUCATION

The nature of the processes underlying improvement after a cerebral lesion presents one of the most difficult problems in aphasia. The uncertainties with regard to improvement in motor function or sensibility are relatively slight in comparison with those surrounding improvement in language and mental functioning. It is widely believed now that mental functions, even the simpler speech processes, cannot be related to any strictly defined cortical areas but involve unified activity of many areas, if not of the whole brain. While a given lesion results in more serious changes in some processes than in others according to its site and nature, it does not result in an isolated loss. On the one hand, the disorder is more or less extensive and on the other hand it is rarely a complete breaking down of any one function. The processes in improvement are also complex. The nature of brain functioning as it must be conceived to account for the improvement which appears clinically has always aroused intense interest. In general there has been less interest in the practical problems of reeducation in aphasia, for therapy has often been tried and found ineffectual, and has always been difficult to evaluate in relation to the other factors making for improvement.

The Processes Underlying Improvement

The term "improvement" is here used to cover the many types of change which may appear in the same case or in different cases and which are manifested in better reactions on the patient's part. These include the recovery which comes with lessening of the pathology and more satisfactory physiological functioning, improvement through a readjustment to the abnormal condition and an adaptation of the behavior which is still within the patient's power, and, finally, whatever improvement may be possible by an extension of activity to areas which have always been closely related to the function disturbed, whether neighboring areas in the same hemisphere or corresponding areas in the opposite hemisphere. Whichever of these processes is operative, the extent and, indeed, the possibility of recovery of course depend on a number of general factors, chief among which are the condition of the brain and the individual as a whole, the patient's age, and his intelligence and interest.

The improvement occurring in most cases within a few weeks undoubtedly reflects a decrease in the edema and more satisfactory conditions of circulation. In the thrombotic cases there is not only an increased amount of circulation in the chief vessel and its distribution where circulation has been shut off, but anastomotic vessels play a part in furnishing blood to some or all of the diseased tissues. In cases of hemorrhage, the condition improves as the edema decreases and as the blood is removed by leucocytes. In tumor cases after successful surgical intervention the situation is again different, with a decrease in the edema and also in the amount of space-taking material within the enclosed cavity. In traumatic cases with actual concussion, where there is widespread destruction of tissue and replacement of that tissue by glial fibers, the lessened edema with restoration of function in those structures which have been only temporarily damaged brings about considerable improvement. From the point of view of the aphasia, the clinical changes consist of a less severe and usually a less extensive disorder. Instead of appearing as a "total" aphasia, the case begins to take on the characteristics of a more specific type, and with continued improvement in physiological conditions the disorder gradually becomes less marked.

The general characteristics of the pathology and the consequent changes in physiological functioning are fairly well established, but the more extensive and indirect effects are less clear. The most important hypothesis in this connection is Von Monakow's theory of diaschisis, which is to be found in his great work on cerebral localization published in 1914.[15] The theory is based on a recognition that anatomical delimitation of the lesion and a static conception of its effect are inadequate. It is essentially a hypothesis of the dynamics of nervous functioning when normal function is disturbed by a lesion. In the opinion of Von Monakow the abnormal process does not depend only on the non-functioning of the area destroyed by the lesion, but on the non-functioning of the association fibers in connection with the destroyed area. He represents this failure in conductivity as a break in the neurone connections or increased synaptic resistance. With the lessening of the effects of this widespread lesion, improvement results. The theory of diaschisis has been rather widely accepted up to a certain point, but does not explain all of the improvement.

A close analysis of behavior shows that improvement is not altogether the result of a recovery of function such as might occur directly or indirectly with a lessening of the pathology. It is also apparent that the patient improves because he is able to develop, on the basis of the performances which remain in his power, new and more or less adequate reactions to take the place of those he has lost. When, for example, the patient becomes able to do simple problems in arithmetic fairly well, it is not necessarily true that his old performances have returned; he may have found that he can no longer add by the old methods and so has substituted a new method of adding by counting. Goldstein has been the leader in emphasizing the "round-about" methods by which the patient achieves what is superficially the same response as before the disorder but fundamentally a different response. He has demonstrated the careful, qualitative analyses of behavior which are necessary to show whether a given response is a return of function or a substitution of a different function, and also the importance of the substitute methods for therapy. There seems to be no doubt that much of the patient's improvement depends on a readjustment of his behavior as a whole with the development of new methods of response to compensate for those affected by the disorder.

---

[15] C. von Monakow, *Die Lokalisation im Grosshirn*, 1914, 26–34.

There is more doubt as to the occurrence of improvement in the sense of a restitution and not a substitution of function, through the extension of activity to related areas. The part played by the right or non-dominant hemisphere has been in dispute ever since Jackson brought the problem to the fore and said the more automatic responses were within its province. There are now investigators who believe that the uninjured hemisphere cannot take over the function of the injured, and that the performances which appear are simply manifestations of the activity always characteristic of that hemisphere. There are others who believe that the right is not only operative to some extent in language processes but can actually increase its activity when the left hemisphere is damaged. The matter is difficult to prove either one way or the other. As Goldstein has said, the only cases which offer suitable evidence are those where the injured hemisphere has clearly been the dominant before the disorder, a condition which is in itself hard to demonstrate, and where the area in question in the dominant hemisphere has been completely destroyed.[16] If this second condition is not fulfilled, there is the possibility that restitution might have occurred through the extension to parts neighboring those destroyed.

The problem of restitution of function in the peripheral as well as the central nervous system received its most interesting recent discussion at the Eighteenth Annual Congress of the German Neurological Society in 1930.[17] With regard to improvement in speech and mental functions, the most significant papers were those presented by Foerster and Goldstein. Goldstein's views as to the effect of the lesion on the organism as a whole have already been discussed at some length. They make his point of view on therapy quite different from that of other investigators who attempt to improve the particular performance disturbed, and place less emphasis on the adjustment of the whole environment to the changed organism and on the development of substitute methods to compensate for those affected. In Goldstein's opinion the major part of the improvement which occurs after a brain lesion, aside from that dependent on the lessening of the pathology and of diaschisis, is the result of the readjustment of the changed organism with the development of substitute behavior to meet the most essential demands of the environment. He would apparently admit, however, that the patient could sometimes relearn through systematic training, that is, that he could regain a certain degree of a lost function through training and, neurologically, by means of the remaining part of the apparatus which was only partially impaired. Foerster differs in that he gives greater importance to the taking over of the function destroyed by means of the activity of a related structure, not of course a structure which had been distinct in the normal condition but one which had always acted with the disturbed function in a collective working group. It is noteworthy that the clearer recognition of the extensive areas normally involved in a complex function like language enables the modern student to postulate a reorganization in Foerster's sense or a readjustment in Goldstein's sense, either of which is based on the activity of parts normally operative and remaining unaffected; whereas many of the older writers, with their conception of a more rigid localization of function, would have had to assume that the improvement depended on the taking over of function by an uninjured area which was not normally operative in the activity.

---

[16] Goldstein, *Die Topik der Hirnrinde in ihrer Bedeutung für die Klinik*, Psychiat. Neur. Wsch., 1924, 26, 55–60.

[17] Arch. Neur. and Psychiat., 1932, 27, 461–480; 725–752; 967; abstracted by W. J. Bernis from Dtsch. Zsch. f. Nervenhk., 1930, 115, 248–314; 116, 1–26 and 28–45.

On the nature of the course in aphasia there is a wealth of material to be found in the work of Bonhoeffer, Von Monakow, Pick, Goldstein, Head, and others. The subject which has received most attention is whether certain groups of clinical findings represent independent syndromes or stages in the course of regression or recovery. These problems have been considered in the descriptions of different types of disorder and will not be discussed further. There is, however, another interesting question of more general significance. It has frequently been said that the deterioration in aphasia may be looked on as a regression which reverses the processes of development. The disturbances have been thought to follow Ribot's Law, with the oldest functions remaining least affected. The course of restitution is then the opposite of that of deterioration, and the newly acquired performances are the last to be restored. Pick especially emphasizes that the strongest rather than the oldest remain, and that the first to reappear are those which were best established. A survey of the literature shows too great a readiness to conclude that the deterioration has reversed the course of development and that the improvement repeats it.[18] Actually there seem to have been a great many complex cases where an analogy between the deteriorated performances and any developmental stage would be exceedingly far-fetched.

It may be noted in passing that one of the most interesting opportunities for analysis of the language processes in regression and recovery is to be found in the study of polyglots who develop aphasia. Naturally the European literature is much richer in such studies than the English or American.[19] They show, as do the reports of aphasic difficulties in one tongue, that there are no fixed rules for the deterioration or improvement which hold for all cases or even for all cases where the conditions of learning, experience, and interest have been similar.

Reeducation

Opinions are divided as to whether improvement can be aided or prolonged by training, and there has been comparatively little decisive evidence either one way or the other. The question requires controlled study, and yet a control is difficult to establish. It has not been possible, for example, to divide a large group of cases arbitrarily into two sections, train the patients of the one while those of the other live under normal conditions, and then to measure the progress in each section. An experiment of this type would be of great value. In its absence, however, significant data could be obtained either from cases where the condition had been stationary for some months before training was begun; or from cases examined shortly after the onset, left untrained for six months or so, examined again to estimate the progress during this interval, and then trained for a similar period and reexamined to compare the progress with and without training. Unfortunately such cases are rare. Even though some authors advise against training, particularly in apoplectics, for six months after the onset, most patients who want training at all want it as soon as it can be given. As a matter of fact most intelligent patients begin to train themselves very soon, and their self-training and variations in the incidental training from daily experience further complicate any decision as to the effect of reeducation.

---

[18] There are different conceptions even among those who draw an analogy between the deteriorated and the developmental conditions. Those who think of the analogy in general terms find the type of thought characteristic of the aphasic like that of the child or primitive. Others make more detailed comparisons and find similarities between the specific responses, words, and grammatical constructions of the aphasic and the child at certain developmental levels.

[19] Among the recent papers see especially Pötzl, *Aphasie und Mehrsprachigkeit,* Zsch. f. d. ges. Neur. u. Psychiat., 1930, 124, 145–162; E. Stengel and J. Zelmanowicz, *Ueber polyglotte motorische Aphasie,* Zsch. f. d. ges. Neur. u. Psychiat., 1933, 149, 292–311.

At the present time a judgment on the value of reeducation must be based almost entirely on the opinions of those investigators who have attempted it, and decided from the course in the individual case whether or not a greater improvement seemed to have occurred than would have been probable without training. The majority opinion here is that reeducation is likely to bring a greater improvement and one which continues over a longer period of time.[20] The beneficial effects of training on the patient's mental state have also been frequently noted.

Naturally the possibility of improvement varies with the nature of the pathological condition, and also with the nature of the aphasic disorder. Most of the early studies of improvement as a result of training were on vascular cases. Many of the traumatic cases during the War, usually of course in young men, adapted well to training. As to the tumor cases, training has naturally never been suggested when pathological processes were working against any improvement, but it has been effectual after successful operative treatment.

Until the time of the War the methods employed in reeducation were largely those used in teaching children, together with the special techniques advised by Gutzmann, Goldscheider, Wylie, and Dana. In 1904 Weisenburg reviewed the German methods in a discussion following Mills' paper on the training of aphasic patients.[21] From the point of view of present-day opinion Mills' work is to be especially commended because it was not given over to the more artificial methods of training then widely advocated and it was based on a recognition of the fact that the aphasic, because of his earlier experience, his already organized brain activity, and his special speech loss presented a different teaching problem from the child.

---

[20] For data on the results of training see: Goldstein, *Die Behandlung, Fürsorge und Begutachtung der Hirnverletzten,* 1919, where a number of important cases are presented, at least one of which is a good control case in that he made little progress for 3½ months after the injury and considerable progress in the first two weeks of the training which was then begun; Poppelreuter, *op. cit.,* I, 276–292; C. H. Frazier and S. D. Ingham, *A Review of the Effects of Gun-Shot Wounds of the Head,* Arch. Neur. & Psychiat., 1920, 3, 17–40; H. Göpfert, *Beiträge zur Frage der Restitution nach Hirnverletzung,* Zsch. f. d. ges. Neur. u. Psychiat., 1922, 75, 411–459; Singer and Low, *The Brain in a Case of Motor Aphasia in which Improvement Occurred with Training,* Arch. Neur. & Psychiat., 1933, 29, 162–165. Studies on the particular problem of the course of the disorder with reeducation are comparatively rare, but pertinent facts may be culled from case reports in many articles. For example, in Lotmar's recent study of disorders in word-finding, he reports eleven cases chosen because they had comparatively slight disorders. (*Op. cit.,* 100–103.) Eight of these, seven of them gun-shot wounds, had received long training, and the records show that at least seven had improved considerably. The records of course do not indicate whether they would have improved without training.

[21] Mills, *Treatment of Aphasia by Training,* J. A. M. A., 1904, 43, 1940–1949.

With the War the large number of traumatic cases which had to be cared for unless they could be rehabilitated, forced a new consideration of the problems of reeducation and a new attempt to work out more satisfactory training methods. The result was a number of important studies, chief among which is Goldstein's *Die Behandlung, Fürsorge und Begutachtung der Hirnverletzten*.[22] In this volume are to be found examples of the examination and training methods employed in different types of cases. The author makes it clear that the first requirement in training is a satisfactory examination. It is necessary to discover not only the limits of the patient's ability in different performances, but the nature of his difficulties and the methods by which he can still succeed. His training then consists in relearning specific responses, if this is considered to be worthy of the attempt, and in learning techniques of substituting methods within his power for those which have been disturbed.

Many investigators have found that after training the patient showed improvement not only in the performances trained but in various others. This condition might indicate that the progress did not result from the training but would have occurred in any case, or it might indicate that there was "transfer of training." Göpfert supports this second possibility as a result of his findings on a carefully studied case of motor aphasia; the patient improved in oral arithmetic over a half-year period when he was being trained only in reproducing number series and sentences, learning word pairs, giving automatic word series, and memorizing frequently used sentences and familiar stories.[23] Göpfert assumes that the training improves "memory," and thus improves calculation which is dependent to a large extent on memory. Actually there is not enough material in the literature to prove conclusively whether there has been a transfer of training from the performance drilled to another, whether this transfer results because of similar elements or similar structures, or whether widespread improvement after the training of a few performances is an evidence that general recovery processes and a different attitude on the part of the patient are responsible for the changes.

---

[22] The reader is referred to this book for suggestions as to training methods, which are not discussed in detail in this section. For the methods used in this research see Chapter XVI and individual case reports referred to there.

[23] Göpfert, *op. cit.*, 411–431.

There have been few experimental studies of learning as distinguished from reeducation in aphasia. They are difficult to arrange unless patients remain for a satisfactory length of time in an institution where conditions can be controlled, but they would be of great value for an understanding of the nature of the disorder and the learning processes. One such study was carried out by Klein in 1930 on a group of six aphasic patients.[24] His findings are interesting in spite of the small size of the group. The problem set was a modification of Ach's experiment, the learning of certain nonsense syllables for figures of particular sizes and weights. The results show that while the new words were affected by paraphasias and other disturbances characteristic of the particular disorder, they could be learned by aphasics of both sensory and motor types and they could be used to form concepts. Klein discusses the characteristics of the learning as compared with normal learning, a very important problem in connection with the understanding of the language disorders, but the most significant finding of his study for the present discussion is that aphasic patients can and do learn, even if slowly. This evidence from an experiment on new learning then supports the results from cases where relearning has been successful. On the whole, the proportion of the previous work which has been effective is large enough to warrant greater attempts at reeducation than have ever been made.

3. APRAXIA AND AGNOSIA

Early Views and Modern Methods of Study

The characteristic phenomena of apraxia and agnosia, like so many of the important aphasic disturbances, were first described by Hughlings

---

[24] R. Klein, *Ueber die Wortgestalt und ihren Bedeutungsinhalt bei Aphasikern,* Zsch. f. d. ges. Neur. u. Psychiat., 1930, 129, 543–582.

A learning experiment of a different type was made by Sapir under the influence of Pavlov's work (1929). Thirteen aphasic patients were trained in several ways: first, to respond to a certain stimulus word by another word, i.e., to give a conditioned reaction in Pavlov's sense; second, to repeat series of words with slight phonetic changes; and third, to learn a two-word sentence thoroughly and then say each word separately. The author concluded from these studies of the "neurodynamics of the speech apparatus" that the activity of reflex connections in the speech apparatus was greatly decreased and the processes of inhibition abnormal in aphasic patients.

Jackson. In 1866 he pointed out the peculiar defect in voluntary action shown by the patient who could not put out his tongue when asked to do so or imitate the movement, but could use his tongue well for the more automatic performances of eating and swallowing. A few years later he found a patient who could not recognize objects, persons, or places, and designated this condition as imperception. During the remaining years of the nineteenth century various terms were used for both apraxia and agnosia. Meynert, Wernicke, and others adopted Finkelnburg's term "asymbolia," and spoke of a motor and sensory type, often, however, without making the sharp division between the disorders of a motor and of a sensory nature which later became customary. On this point these early investigators were thus nearer to the modern students who find apraxia and agnosia closely related than were many of the men in the intervening years. Pick and Heilbronner, however, always emphasized the close relation between the two. Pick preferred the term "apraxia" to "asymbolia," and following Heilbronner it became fairly general to use "apraxia" for defects of movement and Freud's term "agnosia" for defects of visual, auditory, or tactile recognition.

As a result of the famous case Liepmann reported in 1900, the concept of apraxia became much more clearly defined.[25] The disturbances in purposive movement which Liepmann thought the essential mark of the disorder were particularly obvious because the performances of the right hand were affected while those of the left were normal. During the ten or fifteen years after this case was published there were many studies of apraxia and agnosia, and most of them followed Liepmann's views of the disorders. In 1914, however, Von Monakow took a different stand and by his criticisms prepared the way for a new consideration of the disorders.[26] He did not believe that they could be understood simply as loss of movement or perceptual images. He pointed out the many spatial and temporal components which work together in the development of movement or perception and the interdependence of motor and sensory aspects. The factors involved seemed to him so complex as to indicate activity of the whole cortex, and he rejected any strict localization of the lesions in apraxia and agnosia. He did admit, however, that injury of certain areas, the Sylvian region for apraxia and the occipital lobes for agnosia, was particularly likely to lead to these disorders. With restricted lesions he believed that the disturbances were transitory. Lasting changes appeared only with extensive lesions, and in such cases he did not find the disorders pure. Signs of both apraxia and agnosia were likely to appear together, and aphasia was usually part of the picture. With the exception of Head and a few others, subsequent investigators have disagreed with Von Monakow as to the extent of the typical lesion, but they have been led by his views to make more careful studies of the complexity of the disorders.

---

[25] Liepmann, *Das Krankheitsbild der Apraxie* (*"motorischen Asymbolie"*), 1900.

[26] Von Monakow, *op. cit.*, 439–547.

The complexity has been the more clearly recognized because methods of examination have become increasingly more satisfactory. This advance has come about partly through the more thorough use of the traditional tests for apraxia and agnosia and partly through the introduction of new methods. Grünbaum has recently advocated a method of studying disturbances of movement by having the patient try to carry through two activities at once, one with either hand.[27] In demonstrating "constructive apraxia," Kleist and Strauss have used an interesting series of tests consisting of laying out sticks to copy a given pattern, building with blocks, and so forth.[28] The tests were not originated by these authors but have been more widely used since their work. Other single tests of value have been developed, notably Poppelreuter's test of cutting out a paper star from a model.[29] In the field of visual disturbances, Poppelreuter showed the value of tachistoscopic studies, which often served to bring out abnormalities which were not demonstrable when the test material was exposed for longer times. In the analyses of the War cases this author emphasized the retardation characteristic of the pathological response and the quantitative differences between the normal and abnormal while Gelb and Goldstein concentrated rather on qualitative changes of behavior, using a number of tests chosen or devised in accordance with the principles of *Gestalt* psychology.[30] They went further than Poppelreuter in extending the examination to include tests of the so-called higher mental processes so that changes here could be studied in relation to those in movement and perception.

---

[27] Grünbaum, *Aphasie und Motorik,* Zsch. f. d. ges. Neur. u. Psychiat., 1930, 130, 385–412.

[28] H. Strauss, *Ueber konstruktive Apraxie,* Msch. f. Psychiat. u. Neur., 1924, 56, 65–124.

[29] Poppelreuter, *op. cit.,* 233–237.

[30] Poppelreuter thought of this retardation as a psychical phenomenon; Stein has recently concluded from his work on visual perception that it may depend on a simple change of excitability or a raising of the threshhold.

This broadening of the examination to cover many types of mental functioning is an important advance of the fairly recent work, but it must be noted, as in connection with the studies of aphasia, that the examinations have included comparatively few tests of so-called non-language intelligence. The recognition of geometrical forms, the understanding of pictures and arrangement of a picture series, and various drawing tests represent the usual limit of the examinations in this field. The result is that the patient's simpler and largely habitual, motor and perceptual responses were well known, but his more complex responses, still within the field of movement and perception but involving a higher degree of intelligent response, were almost entirely a closed book.

Another line of advance has been experimental study of the psychophysiology of the processes involved, and especially the visual processes. Stein's recent work in visual perception has shown that the whole problem must be analyzed more closely, with greater regard for the physiological characteristics of excitability and changes in threshhold and for the movement factors in perception.[31]

The material derived from the cases of brain injury during the War has formed the basis of many of the contributions on apraxia or agnosia during the last fifteen or twenty years. The most recent of these is Kleist's book on brain pathology where all apraxic and agnosic disturbances are surveyed whether or not they could be studied directly in the War cases. The approach here is structural rather than dynamic, and there is unfortunately no recent and equally extensive survey from the dynamic point of view. For an intensive analysis of disturbances in visual perception, the reader is referred to Quensel's admirable monograph, *Erkrankungen der höheren optischen Zentren*.[32]

Principal Types of Apraxia and Agnosia as They Are Usually Differentiated

A thorough survey of apraxic and agnosic disturbances and the relation of these to other pathological changes is beyond the limits of this book. It will be necessary, however, to summarize the principal forms of disorder as they are usually outlined and described.

---

[31] Discussion of Stein's work in Quensel's monograph, *Erkrankungen der höheren optischen Zentren*, Kurzes Handbuch der Ophthalmologie, VI, 1931, 410–414.

[32] *Op. cit.*, 324–475.

1. APRAXIA

With the addition of constructive apraxia as defined by Kleist and Strauss, the classification of apraxic disorders still follows Liepmann's divisions of limbkinetic, ideokinetic, and ideational disturbances.[33] In general the views on localization have not changed a great deal; types showing a predominance of "motor" symptoms are related to more anterior lesions while "ideational" forms are said to depend on lesions further back in the parietal lobe. Many investigators note, however, that the distinction between the various forms is not rigid.

a. *Limbkinetic or innervatory apraxia.* This form is closest to the simple motor disorder, for while there is no loss of motor function, or rather no such loss is supposed to cause the apraxia, the patient is slow and awkward in movement. He appreciates the nature of the movement but cannot carry it out with ordinary skill, and he shows difficulty with both simple and complex movements. The loss of skill may be limited to one part of the body, for instance, one arm and hand, or the face and tongue muscles. Liepmann called the disorder a loss of kinaesthetic engrams. Kleist thinks of it as an intermediate stage between paralysis and a memory disorder of behavior, and describes it as a loss of the innervatory memories for complex forms of movement developed largely through training. He attributes it to an injury in the motor cortex, on the left side in the case of a right-sided disturbance, and on the right in case of a left-sided disturbance. Kleist does not agree with Liepmann that there is any innervatory dyspraxia of the left hand as a result of left-sided injury of the anterior central convolution or of injury of the corpus callosum.

b. *Ideokinetic apraxia.* This second type of Liepmann's is characterized by normal innervation of movements with difficulty in determining what the nature of the single movement shall be. The disorder is more complex than the limbkinetic and has led to greater diversity of opinion. Liepmann attributed it to a break between the kinaesthetic processes and the rest of the brain. Kleist in the War material found that it was usually an amnesic disorder, that is, the patient seemed to have forgotten how to make the movement.[34] Sometimes, however, he made wrong movements, and these constitute the so-called parapraxic apraxia. Kleist believes that all the disturbances which can be classified as ideokinetic, whether of the face, tongue, and head or of the arm, depend on injury of the left parietal lobe in the right handed. They represent a kinaesthetic apraxia, a coordination disorder which is on a higher plane than ataxia from loss of kinaesthetic sensations. He finds that ideokinetic apraxia of the left hand is always amnesic in character and usually occurs only with paralysis or apraxia of the right.

---

[33] The possibility of considering failures in the production of speech sounds or of letter forms in writing as apraxic, or disturbances in the recognition of speech sounds or letter forms as agnosic, has already been discussed in connection with Liepmann's apraxic theory of aphasia (pages 37–38) and in connection with the so-called pure forms of aphasia (pages 51–53). It was noted that the disturbances in the executive mechanisms of speech production or in the receptive functions are not isolated in cases of cerebral lesion with aphasia, but appear together with more extensive changes in language and behavior. No absolute distinction can be made between the simpler and the more complicated disturbances, and it is for this reason, as Head rightly contended, that the simpler expressive and receptive speech defects should not be classified as apraxic or agnosic but should be considered as a part of the complex aphasic picture. Consequently disturbances in the executive mechanisms or receptive functions of language will not be discussed in this section on apraxia and agnosia.

c. *Ideational apraxia.* This disorder is the third type described by Liepmann, and thought to depend on a faulty conception of the movement as a whole with confusion as to the spatial and temporal relations of the parts in the movement sequence. For example, the patient is unable to strike a match and light a cigarette properly; he may strike the match on the wrong part of the box or strike with the cigarette instead of the match. An apraxia of this complicated ideational type obviously involves perceptual as well as movement disturbances, but the chief difficulty remains an inability to carry out the movement properly. Because of the complexity and extent of the changes Liepmann at first assumed that it depended on a general brain disorder. Later he attributed it to lesions in the parietal lobe and this point of view is the one most widely held at present.

d. *Constructive apraxia.* Some of the errors Liepmann described were spatial errors, but he did not differentiate a particular type of disorder on this basis. In Kleist's opinion the War material presented a number of cases in which spatial errors were in the foreground, showing, as he thought, a break in the visuo-kinaesthetic connections; he defined this disorder as "constructive apraxia." In typical cases the patient experiences difficulty in laying out sticks to copy a given design, in building with blocks, in drawing, and sometimes in placing block letters to form words, and in writing. He may show that he has a concept of the object he is to draw which fails only in spatial orientation or in the spatial relationship of the parts. Kleist finds that the drawings of the constructive apraxic patient are reminiscent of children's drawings, meaning probably only that the child's drawing may also show some spatial errors.

The apraxic patient of this type usually seems to recognize his faulty constructions. Thus while visual factors are of course important for the behavior in question, disturbances of the visual agnosic type are not considered primary. Both Kleist and Strauss believe that the disorder depends on a break between the visual and the kinaesthetic, and not on a disturbance in the visual processes themselves. For this reason they reject Poppelreuter's concept of a visual apraxia, a form of disorder which is also characterized by spatial errors but which is, in

---

[34] This author notes that what he means by amnesic apraxia is not a failure in part of the movement sequence which is found in the third type of apraxia, ideational, and which represents Liepmann's and Von Monakow's concept of amnesic apraxia.

Kleist's opinion, too complex to be a "useful" concept of brain pathology. Kleist finds the anatomical basis of constructive apraxia in a lesion of the angular gyrus, the presumed field of visuo-kinaesthetic associations.

2. AGNOSIA

It will be evident that the types of apraxia range from simple disorders, in the sense of being closely related to motor power itself, to the more complex psychical disorder of the ideational form. In the field of agnosia there are similar ranges between the simpler and the more complex disturbances. The situation here, however, is far more complicated: first, because there is the threefold problem of disturbances in the tactile, auditory, and visual fields; and second, because the disturbances in visual perception are so very complex, with many forms in the field of agnosia itself and many others on the borderline.

a. *Tactile agnosia.* Difficulty in the recognition of objects or forms by touch, or astereognosis, is usually grouped with disorders of sensibility. It almost always occurs together with other sensory disturbances, and particularly with faulty position and movement sense. These relationships are well shown by Kleist's analysis of the findings for the cases which came under his observation in the War (1934). He notes the fact that astereognosis can be confined to single fingers as a reason for differentiating between this disorder and the higher conceptional types of agnosia. In his opinion, cases where touch recognition fails and stereognosis remains are so rare as to cast doubt on the existence of a pure conceptual tactile agnosia.

b. *Auditory agnosia.* Comparatively little is known about difficulties in recognition in the auditory field for they do not lend themselves to study so well as the visual difficulties. In addition to disturbances in the recognition of speech sounds, two other types have been differentiated theoretically: psychic deafness for noises and music deafness or sensory amusia. The latter will be discussed in the section on amusia which follows. The former is still more or less of a theoretical question, for satisfactory cases of noise deafness in the sense of an agnosia are rare. So far the most interesting studies have been made in complicated cases showing not only difficulty in recognizing noises but disturbances in the recognition of tones, melodies, and speech sounds and usually much more complex manifestations of sensory aphasia.

c. *Visual agnosia.* Disturbances in visual recognition have been worked over for years, and the doctrine is very complex. Several types of disorder have been differentiated and said to be independent, but in actual fact few cases show only one group of symptoms. Nevertheless, in many cases one group is by far the most prominent. Attempts to arrive at an exact localization for the various types of visual agnosia have not been successful. In the majority of cases the lesions are extensive; the crucial areas in so far as these can be delimited with regard to visual agnosia for objects, pictures, and colors, are thought to be the basal part of the occipital lobe, the underlying tissue and splenium. The destruction is often bilateral but may be most severe on the left.

(1) Visual agnosia for objects, pictures, and colors: Psychic blindness, which includes visual agnosia for objects and pictures, is loosely defined, and as Von Monakow, Poppelreuter, and others have noted it varies considerably from case to case. Following on the disturbances shown by Munk's dogs, the mark of psychic blindness has been said to be the inability to recognize objects by sight when visual processes at the sensory level were intact. Theoretically, recognition by touch is still possible. If, for example, a hair-brush is held before the patient, he does not recognize it as a meaningful object or he may misunderstand it. He is at a loss to know what he would do with it. In "pure" cases of psychic blindness, he recognizes it as soon as he is allowed to touch it.

Lissauer distinguishes two types of psychic blindness: the apperceptive, or a difficulty in getting the image of the form of the object normally, and the association, an inability to arouse the other images of the object from various sensory fields and to evoke its name. The two groups have been accepted by most authors, but with differing concepts of the nature of the processes involved.[35] The early hypothesis of a loss of visual memory images or a break between these and images from other sensory fields has for the most part given way to a better understanding of the complex, active functions involved.[36]

Another suggested form of psychic blindness appears when the patient recognizes single objects fairly well but not the general significance of a picture. Wolpert calls this difficulty visual *Simultanagnosie,* and Pötzl renames it "situation blindness." It is often tested by the Binet pictures; in typical cases the patient recognizes single parts of the picture but does not understand their relationship or the action as a whole. In Pötzl's opinion this difficulty may be a slighter form of object agnosia. As investigators generally recognize, the understanding of pictures requires a performance which varies rather closely with intelligence. There is then always the question as to whether failure to understand indicates an agnosic disorder in the usual sense or a more general intellectual defect. Kleist would diagnose the failure as agnosic if there were other grosser defects in recognition, and as a general intellectual defect if there were a "weakness of judgment" (1934). This is the procedure usually adopted but it requires thorough studies not only of the agnosic difficulties but of various intellectual performances, and up to the present time the latter have been frequently neglected.

---

[35] Kleist, however, does not believe that the first type should be considered an agnosia; he describes it as "form-blindness" and attributes it to injury of perceptual performances in the calcarine area. He thinks that the true psychic blindness is the associative disorder of the second type, or in the term he uses, visual-object agnosia.

[36] For development of the theory of psychic blindness, see Quensel's monograph, *op. cit.,* 395–398.

(2) Color agnosia: This disturbance appears in connection with various other changes. It is not dependent on color blindness, or inadequate color sense. Kleist defines it as a difficulty in understanding colors as qualities of objects, a faulty color concept, and inability to evoke color images (1934). Gelb and Goldstein relate it to amnesia for color names (1924). Their view as to the basic disorder, a failure of categorical behavior, has already been discussed in the section on amnesic aphasia. Pötzl believes that color agnosia and word-blindness form a syndrome. The divergent points of view reflect the variations which actually occur from case to case. Color agnosia is in many ways a more clearly defined concept than psychic blindness, but it cannot be considered as a unitary syndrome.

(3) Visual-spatial agnosia: Disorders of orientation, which Kleist groups under the heading of visual-spatial agnosia, are complex and must be considered from the point of view of motor as well as perceptual factors. Like the other types of agnosia, they appear differently in different cases. Some patients are unable to find their way out of a familiar room, and yet they may recognize the objects in that room. In Wolpert's opinion their difficulty may be understood as a *Simultanagnosie,* a form of disorder discussed above in connection with psychic blindness. If there is a loss of "place-memory," as in many of the older cases, Kleist does not think the syndrome should be classified as a disorder of orientation. A true orientation disorder implies a disturbance in the appreciation of spatial relationships which is not dependent on general mental deterioration, defective perception of forms or objects, or faulty distance perception. According to the current opinion the lesion may be unilateral and lies in the posterior central or parietal areas.

A particular form appears when the disorientation is not general, but affects the relationships of the patient's own body. Pick called this condition "autotopognosia" and said it represented a loss of the "body-schema." The patient is unable to differentiate between right and left or to conceive of objects in their spatial relationship to his own body. The finger agnosia which has been so much discussed recently is in the opinion of most authors a partial autotopognosia.[37] In typical cases patients are unable to name or indicate given fingers at command, and have difficulty even in imitating finger positions. This particular form of disturbance is thought to depend on lesions of the angular gyrus, while a more general right-left disorder is related to the supramarginal gyrus.

The Present Status of the Work on Apraxia and Agnosia

It is generally recognized that the various types of apraxia and agnosia rarely if ever appear in "pure" form. The most satisfactory studies show complicated disorders. This complexity takes on a different significance according to the point of view of the investigator. Those who schematize as far as the material will permit look for distinct parts of the disorder, that is, parts which appear in some cases but not in others, and attempt to determine the site of the lesion responsible for each distinct part. This point of view, which has necessarily been in the foreground in the preceding survey of types of disorder, characterizes the structural rather than the dynamic approach. Its antithesis is the point of view of those authors who find the various parts of the disorder related and consider them manifestations of some fundamental change. Most of the modern work falls between these two extremes, and shows an interest in the analysis of the disorder as a whole and the interrelationships of its parts but a reluctance to attribute all the changes to one fundamental disorder.

---

[37] See Gerstmann's syndrome, page 44.

The first point of view appears clearly in the work of Kleist and Strauss. In his study of constructive apraxia in 1924, Strauss presents the records of fourteen cases to show that the disorder is an independent syndrome.[38] Seven of the cases show constructive and ideokinetic apraxia, two constructive apraxia and disorders of visual attention, and five constructive apraxia without either of these other disturbances. None of the patients have gross visual field defects. All fourteen are, however, complicated cases. Spatial errors are prominent in each and their particular nature together with the fact that they appear now in connection with one set of disturbances, now in connection with another, is said to indicate their independence. It seems clear that no one of the complicating factors caused the spatial errors. It is doubtful, however, whether Strauss gives sufficient weight to the ultimate effect of the many complicating factors. Even the five cases of constructive apraxia without the ideokinetic disturbances or difficulties in visual attention are complicated by two or more of the following factors: age over 80 years, poor original endowment and education, disorientation for time and place, failing memory, aphasia, or apraxia in manipulating objects.

The differentiation of types of disorder in accordance with symptoms which sometimes appear independently of other symptoms and the relation of these types to distinct brain areas is particularly marked in Kleist's work. For instance, he finds color agnosia an independent defect although it appears clinically in conjunction with other groups of symptoms, notably word-blindness and amnesia for color names.[39] It is said to be independent because one or other of these groups may be missing from the picture. Its frequent connection with amnesic aphasia, alexia, and right hemianopsia depends on the fact that the anatomical fields underlying each of these functions are close together.

---

[38] Strauss, *op. cit.*, 73–97.

[39] Kleist, *op. cit.*, 537–539.

The opposite tendency, the search for a fundamental disorder as a basis for the symptoms demonstrated clinically, was most strikingly illustrated by the analysis Gelb and Goldstein made of their famous patient "Schnei." This man would have been classified under the usual system as a case of apperceptive psychic blindness in Lissauer's sense. He was studied for visual perception by Gelb and Goldstein, for intelligence by Benary, and recently for language and behavior by Hochheimer.[40] The lesson which this patient taught was that the abnormalities in different fields were at least to some extent related. Tachistoscopic studies brought out disturbances in visual perception, and analyses of the patient's behavior showed that his reactions were qualitatively different from the normal. With short time exposures, he failed to recognize the given figures because he had not sufficient time to carry through his most successful method of recognition, namely, outlining the figure with finger or head movements. His substitution of this round-about method appeared not only in connection with visual problems but in other fields. He could not tell the difference between a whole tone and a quarter tone unless he was allowed to make head movements. When his eyes were closed and he was told to move a certain part of the body, he could not move that part directly but had first to make a much more extensive movement, sometimes of the whole body, and then narrow it down more and more until he moved the part in question alone. Gelb and Goldstein believed that the fundamental disorder was a "*Gestalt* blindness," an inability to grasp a structure as a whole in the normal fashion. In his studies of intelligence, Benary found the same type of difficulty. For example, the patient was at first completely disoriented on the analogies test. Given a relationship such as "*elbow* is to *arm* as *knee* is to *leg*," he understood only the individual terms but nothing of the unity of the analogy as a whole. In short, most of the evidence went to show that the disorder could not be understood as a series of separate disturbances, but had to be considered as a fundamental change manifested in many different fields. The case has been a successful demonstration that various disturbances may be related, and that the possibility of this relation should always be studied. As an example of a fundamental disorder through injury of the occipital lobes, however, it has come in for much adverse criticism because the pathology was very extensive, including cerebellar as well as cerebral changes. Furthermore, the lesions were of traumatic origin. Poppelreuter and subsequent investigators have therefore contended rightly that it was a case which would be certain to show widespread lesions, and that it was not a suitable case to demonstrate the nature of a disturbance such as psychic blindness.

---

[40] Goldstein and Gelb, *Zur Psychologie des optischen Wahrnehmungs- und Erkennungsvorganges,* Zsch. f. d. ges. Neur. u. Psychiat., 1918, 41, 1–142.

Goldstein, *Ueber die Abhängigkeit der Bewegungen von optischen Vorgängen,* Msch. f. Psychiat. u. Neur., 1923, 54, 141–194.

Benary, *Studien zur Untersuchung der Intelligenz bei einem Fall von Seelenblindheit,* Psychol. Forsch., 1922, 2, 209–297.

W. Hochheimer, *Analyse eines "Seelenblinden" von der Sprache aus,* Psychol. Forsch., 1932, 16, 1–69.

Without attempting to trace all the symptoms to a fundamental disorder or to explain all of them, many of the modern studies have contributed greatly to an understanding of the nature of apraxia and agnosia. More exactly phrased, it should probably be stated that they have succeeded in demonstrating the relationship of various disturbances, without, however, solving the whole problem as to the essential nature of the disorders.

The close interrelationship of the apraxic disturbances has been emphasized by Sittig who finds a psychological consideration of apraxia unprofitable, at least at the present time, and turns to a purely physiological study.[41] From the physiological point of view he believes that apraxia is actually a form of paralysis, a paralysis of "higher potentiality."[42] The disorder may be divided according to the different parts of the body affected. Apraxia of single parts is less frequent than of the body as a whole but does occur and follows Hughlings Jackson's rule that the parts most frequently and earliest affected are those with the most complicated function. Sittig does not believe that there are differences in nature between the types of apraxia as Liepmann thought. He considers limbkinetic a more marked degree of ideokinetic apraxia with disturbances in more automatic movement mechanisms. Thus there are simply a series of stages within apraxia as there are between apraxia and central paralysis. Ideational apraxia, however, caused him more trouble for it is more difficult to conceive physiologically. He put it into his apraxic series by relating it to ideokinetic apraxia, saying that there was no true criterion for differentiating between them.[43] In support of his argument he notes the cases of the literature which have shown apraxia of both ideokinetic and ideational types and also the evidence that the ideational form falls in the realm of agnosia as well as apraxia.

---

[41] O. Sittig, *Ueber Apraxie,* 1931, 91–170.

[42] In a 1933 paper, Sittig describes a case showing "awkwardness of central origin" which seems to him to represent an intermediate stage between central paralysis and apraxia.

Within recent years there has been even more work on the relationship between the more complex forms of apraxia and agnosia than on the relationship between the forms of apraxia themselves. In 1928 Morlaàs contended that ideational apraxia should really be considered an "agnosia of use," for the patient's behavior often showed that while he recognized an object in a certain sense he was unable to use it properly.[44] He might, for instance, know that a pen was used to write with and yet fail to dip it in the ink before attempting to write.

Morlaàs here emphasizes the importance of adequate recognition for behavior, while Grünbaum in several recent studies showing the relationship of ideational apraxia and agnosia, has brought out the importance of behavior for perception. Grünbaum's concept has developed in opposition to the old doctrine that apraxia depends on the loss of images or breaks in their connections. In his opinion action is not built on the basis of images but images develop on the basis of action.[45] In general they appear only when action does not run freely, and they vary according to the motor situation. The same piece of paper, for instance, is recognized differently at different times according to the behavior involved; at one time it may be something to write on, at another something to use in wrapping. Grünbaum finds it impossible to draw any sharp distinction between agnosic and apraxic factors in the disturbed behavior, and believes that there are cases where the disorder should really be called "apractognosia" because the agnosia depends on the apraxia.

The role of perceptual factors in constructive apraxia has been the subject of many recent discussions. When Poppelreuter outlined his concept of "visual apraxia" on the basis of the War cases, he included many of the faulty performances which Kleist later differentiated as signs of constructive apraxia. These consisted of errors in spatial position so that the figure which the patient constructed with blocks or drew was turned in space, errors in spatial arrangements within the figure, and also superpositions and omissions. Kleist and Strauss attributed these errors to a break between the visual and the kinaesthetic processes, and to show where the break came Strauss presented a complex "movement formula" derived from the formulae of Wernicke, Liepmann, and Kleist. Schlesinger then described a case which seemed to him to indicate that the visual role, that is, the part of the visual factors in regulating the movement, is more important in constructive apraxia than Kleist and Strauss indicated.[46] Furthermore, from an analysis of his patient's errors, he decided that some, such as omissions in drawings, did not belong to constructive apraxia at all but to the ideational and agnosic realm. His case is one of the most complicated which has appeared in the modern literature as an illustration of the nature of any particular disorder. With such a complex of sensory, agnosic, apraxic, and general mental changes, appearing incidentally in a woman of 63 who had had a diagnosis of multiple sclerosis for twenty-one years, no definite conclusions could be drawn as to the nature of the visual and constructive disturbances.

---

[43] The criterion he rejects is Liepmann's view that ideokinetic apraxia showed a failure in the single movement and ideational a failure in the movement sequence; he does not discuss other differences between the two forms in the nature of the errors.

[44] Discussion of Morlaàs' work in Sittig's monograph, *op. cit.,* 163–164.

[45] Grünbaum, *Ueber Apraxie,* Zbl. f. d. ges. Neur. u. Psychiat., 1930, 55, 788–792.

Two cases which are clearer, and consequently more satisfactory for the study of the apraxic-agnosic relationship, were presented by Kroll and Stolbun in 1933.[47] These authors find no reason for assuming that the constructive disturbance is a new and distinct form of apraxia and they show how closely interconnected it is with agnosic disturbances. The two cases differed considerably—a characteristic finding—and the second showed great difficulties in spatial orientation.

Orientation disturbances have been found to be frequent accompaniments of the spatial difficulties defined as constructive apraxia. Several studies have been made by Lhermitte and his colleagues, who concur in the general opinion that this form of apraxia depends on a break between the visual and motor processes. Their interest lies particularly in the effect of some of the agnosic disturbances on motor behavior, and they attribute this effect to a change in spatial thought, specifically in representations of external space and the objects in it, relations of the body to external space and the individual's concept of his physical personality.[48] Their discussion seems to separate this type of thought quite clearly from "intelligence," which usually has the misfortune to remain an undefined entity. Their patients showed "somatognosia," or a disturbance in the appreciation of the "body schema" when sensibility is intact. Two of them held the affected arm in a different position from that of central paralysis, and could not reproduce with one arm the passive or active positions of the other. In the third, somatognosia was so greatly disturbed that the patient said he had lost the left side altogether.

---

[46] B. Schlesinger, *Zur Auffassung der optischen und konstruktiven Apraxie,* Zsch. f. d. ges. Neur. u. Psychiat., 1928, 117, 649–697.

[47] M. Kroll and D. Stolbun, *Was ist konstruktive Apraxie?* Zsch. f. d. ges. Neur. u. Psychiat., 1933, 148, 142–158.

The first case, which the authors think typical of Poppelreuter's visual apraxia, was a man of 61, an engineer and teacher of mathematics, who had two cerebral attacks affecting the left arm and hand ten years after an attack of encephalitis. He could do mathematical problems in his head but not put them down on paper, and he showed an interesting series of spatial difficulties, such as not being able to draw a five-pointed star, and disturbances in orientation, with a finger agnosia. He also had an "attention disorder of the left visual field," with a definite tendency to slight the material on that side. The second patient was a military officer, 28 years old, who had suffered a through-and-through gun-shot wound with the entrance over the right temporal bone and the exit on the border between the left parietal and occipital. In his case the constructive apraxia was accompanied by marked disorder of orientation in space.

The disorientation with regard to the individual's own body has been demonstrated by Engerth in the drawings of several patients with parietal lobe lesions.[49] They had much greater difficulty in drawing men, or parts of the body such as the hand, than in drawing houses, trees, pigs, and so forth. In drawing a face one of them tried to get clues by grimacing or by touching his face with his left hand. When he was prevented from doing this, he muttered, "I have a nose and under it a chin," as if the verbalization helped him to get the correct spatial relationships.[50] Engerth agrees with Lange that the patients show a disorder which can be called a loss of the category of direction in space, but because of the greater difficulty in drawing parts of the body he does not think this a complete explanation.[51] He therefore postulates another primary disorder, an "incoherence of the body schema" with resulting difficulty in recognizing parts of the face and hands and in representing these graphically.

---

[48] J. Lhermitte and J. O. Trelles, *Sur l'apraxie pure constructive, les troubles de la pensée spatiale et de la somatognosie dans l'apraxie,* Encéphale, 1933, 28, 416.

[49] G. Engerth, *Zeichnenstörungen bei Patienten mit Autotopagnosie,* Zsch. f. d. ges. Neur. u. Psychiat., 1933, 143, 381–402.

[50] Engerth notes the parallels between these pathological drawings and children's drawings, particularly with regard to the influence of knowledge of the object drawn, as does Bonvicini in his discussion of the drawings of the sensory aphasic. (Bonvicini, *op. cit.,* 1745.)

[51] For Lange's theory, see page 45.

Disturbances in orientation in what Grünbaum calls the individual's "own" as opposed to "foreign" space, difficulties in constructive behavior, including drawing and writing and disturbances in calculation, appear in the "parietal syndrome" which has been the subject of so much recent study. These disturbances have already been referred to as Gerstmann's syndrome, and it was noted that Klein related them to the differentiation of the hand and thought the functional sphere of the hand built up in the parietal lobe (1931). In a new paper this author tries to reach some conclusion as to the nature of apraxia.[52] He does not think that the disturbances can be explained in terms of the degree of automatization of the functions involved, and rejects the attempts which Sittig has made in this direction. The question is an important one and has always been in the foreground in discussions of apraxia. When Jackson first described the apraxic disturbance, his example was the patient's inability to put out his tongue voluntarily when he could still put it out in the course of such automatic actions as licking crumbs from his lips. According to Sittig's physiological conception of apraxia, the disturbances appear in automatic movement mechanisms. In this sense there are no voluntary movements as opposed to automatic; all movements are more or less automatic and the more strongly automatic the movement the more severe must the disturbance be to affect it. Klein objects to this view on the ground that, if the degree of automatization were the decisive factor, the apraxic disturbances ought to appear differently in patients who have very different manual habits; clinical experience, however, shows no such differences. In his recent discussion of constructive apraxia, Zutt has opposed the "automatic" and the "constructive" performance, and noted that the constructive performance is often affected while the automatic remains relatively free.[53] The greatest difficulties appear in drawing or in laying out sticks to copy a model while the more automatic responses of writing may be still within the patient's command. In his case of spatial disorder, Wagner also found the most serious disturbances in the less automatized movements.[54] There is no doubt that both apraxic and agnosic disturbances as they are now understood extend beyond the relatively automatic performances, and that the severity of these disturbances does not vary with the degree of automatiza-

[52] Klein, *Ueber Apraxie,* Zsch. f. d. ges. Neur. u. Psychiat., 1933, 147, 383–413.

[53] J. Zutt, *Rechts-Linksstörung, konstruktive Apraxie und reine Agraphie.* Msch. f. Psychiat. u. Neur., 1932, 82, 253–305; 355–395.

[54] W. Wagner, *Ueber Raumstörung,* Msch. f. Psychiat. u. Neur., 1932, 84, 281–307.

tion of the processes involved. With the development of more satisfactory test methods, the disturbances have been found in performances which are increasingly complex and further from the automatic. It may be questioned, however, whether the terms apraxia and agnosia should be extended to cover all these phenomena, or whether they would not be more useful if they were limited to disturbances in motor skills and habitual acts which have become largely automatic and in perceptual responses which are also so familiar as to be more or less automatic. Such a limitation would not, of course, mean that the more extensive disturbances could be overlooked, but that they would be considered rather with a large group of difficulties which reflect a change in mental functioning in a non-verbal field, a change which many authors have discussed as a disorder of spatial thought.

4. AMUSIA

The disturbances of amusia like those of aphasia have been divided into two main groups: the motor, or the difficulty in producing tones and melodies either in singing or on some musical instrument, and the sensory, or the failure to recognize and understand tones or melodies. The motor amusias have frequently been found with disturbances in motor speech and the sensory amusias with word-deafness. As in aphasia, the motor disturbances have been related to apraxia and the sensory to agnosia.

In the recent work of Kleist this point of view is maintained and the discussions of amusia, like those of aphasia, apraxia, and agnosia, are concerned chiefly with the differentiation of types of disorder and the relation of these to lesions of certain cerebral areas.[55] Kleist distinguishes two forms of motor amusia: the usual difficulty in producing melodies and a new form, tone-muteness, which he takes to be a part of limbkinetic apraxia of face, tongue, and larynx movements. He presents little factual evidence of this new form; only one of his War cases, a motor aphasic, could not sing or whistle a note but could hum a melody correctly. Following his plan of detailed localization, Kleist attributes tone-muteness to a lesion in the lower third of the left anterior central convolution, below the center for whistling and above that for singing. This location of a "singing center" does not coincide with that Henschen made on the basis of his survey of the literature up to 1920; he concluded that the crucial area was the lower border of the *pars triangularis* of the third frontal convolution. He admitted, however, that there were few if any decisive cases. There is even less data on the localization of the lesion in "instrumental motor amusia," for, as Kleist notes, the cases in point have had extensive apraxia of parietal lobe origin.

---

[55] Kleist, *op. cit.*, 649–685.

In the field of sensory amusia Kleist again distinguishes a new form, tone deafness, or an inability to differentiate the pitch and quality of tones. He considers that this is really a perceptual rather than a gnosic disorder, but prefers to extend the term "amusia" to cover it. He finds the perception of pitch and tone quality often preserved in the second form of sensory amusia, "pure" melody deafness, which is essentially a difficulty in appreciating intervals in their rhythmic structuration as melodies. With regard to the localization of melody deafness, Henschen had decided on the most anterior part of the temporal lobe, or the temporal pole. Kleist, however, because one of his cases showed bilateral injury of both temporal poles without sensory amusia, rejects Henschen's view and assigns the center for melody deafness to the middle third of the first temporal convolution, Brodmann's Field 22, where he also localizes deafness for noise sequences and for word sounds.

The comparative rarity of the amusias, motor or sensory, and the fact that they appear much less regularly than speech disorders with a lesion of the dominant hemisphere as indicated by handedness have suggested that musical abilities involve the activity of both hemispheres. The older supposition that music depended largely on the right hemisphere and speech on the left has been discarded by recent investigators. Kleist suggests in his discussion of amusia that the dominant hemisphere may not be dominant for every activity, and that the man who is left brained for hand skills may possibly be right brained for speech or for singing. Goldstein attacks the problem of the preservation of singing in spite of great difficulty in speaking through a functional consideration of the two performances.[56] He believes that singing is likely to remain in spite of speech disturbances when it is an activity closely connected with the patient's affective life. Under such conditions, the song is not representative speech, but a "series speech" performance expressive of feeling, like a prayer. Feuchtwanger's conception of the relation between the amusias and lesions of the right and left hemisphere expresses the belief that both hemispheres are active in many speech as well as musical performances. In his recent monograph on amusia, he suggests that not only hearing itself but the more highly organized auditory experiences in both speech and music involve bilateral cerebral activity.[57] Similarly he believes that both left and right Broca areas are important for expression in speech as well as in music. He notes that musical disturbances often come with speech disorders when there is a lesion in the left hemisphere, and that transitory speech difficulties may often appear as initial phenomena with musical disturbances and a lesion in the right hemisphere.

---

[56] Goldstein, *Die Lokalisation in der Grosshirnrinde,* Handb. der norm. u. pathol. Physiol., 1927, 10, 796–797.

This monograph of Feuchtwanger's is the most important contribution on amusia in recent years. In contrast to the general run of publications on this subject, it is little concerned with the localization of independent types of disorder and greatly concerned with the problems of auditory perception and musical production and with the interrelationship of music and speech.[58] In Feuchtwanger's opinion, the findings for amusia are of direct significance for the problem of aphasia. The fact that expressive and receptive disorders are so clearly differentiated in the musical sphere seems to support a division of expressive and receptive disorders in aphasia, and contradict any such assumption of a unitary disorder as Marie's "true" or Wernicke aphasia. Analysis of cases of amusia shows that there are different types of disorder within both receptive and expressive groups and, especially significant for the aphasia problem, that not all amusic disturbances can be considered symbolic difficulties. Feuchtwanger suggests that in all probability the same situation exists with regard to aphasia, and that here too only a certain part of the picture can be called a symbolic disorder.

[57] E. Feuchtwanger, *Amusie,* 1930.

[58] The work is introduced by thorough reports of two cases, both of them rather complicated. The first is an oboe player, 76 years old, with sensory aphasia, sensory amusia, and dyspraxia. The second is a young woman of 26, a pianist, who showed severe, predominantly motor aphasia and apraxic disorders in addition to the complex motor amusia.

The reports of these cases show the detailed examinations necessary in the determinations of musical disorders. Naturally the specific tests have to be adapted somewhat to the patient's original musical abilities. A suggested test battery, including a fairly large variety of tests not all of which would be necessary in any one case, has recently been given by Jellinek (1933).

V

THE PATIENTS STUDIED IN THIS RESEARCH

1. The selection of the groups
2. Comparative data
3. The aphasic group
4. Summary

1. THE SELECTION OF THE GROUPS

IT is the uncomplicated cases of aphasia which have been of greatest value in the study of the problem. Cases which, in addition to the aphasia, introduce various other factors affecting the language response, are never wholly satisfactory, for no one can establish where the effect of the one factor ends and the effect of the other begins. Consequently it was decided that the aphasic group and the control groups for this research must be kept as clear-cut as possible, and the following criteria were laid down for the selection of the patients:

1. They must be under 60 years of age so as to reduce the possibility of a picture complicated by senile changes.
2. The aphasic patients and the control cases of unilateral cerebral lesion without aphasia must not show any signs of a disorder known to affect mental functioning, for example, psychosis, general paralysis, advanced cerebral arteriosclerosis; the "normal" control cases must likewise be free from any disorder known to affect mental functioning and they must also be free from any neurological disturbance.
3. All patients must have been English-speaking by birth.
4. They must have adequate sight and hearing.

As a result of these limitations, three relatively clear-cut groups were obtained: the aphasic, the group of cases with unilateral cerebral lesion but no aphasia, and the so-called normal adult group. The study was not confined, however, to these. It was recognized that the various speech defects and changes in mental functioning which appear in many other types of nervous disorder would be of interest in connection with the aphasia problem. Consequently, complete examinations were made of patients with tabes dorsalis, multiple sclerosis, and post-encephalitic Parkinsonism. Furthermore, it was recognized that full study of the aphasia problem must take into account the conditions in which aphasia is only part of a complex picture, and examinations were made of a number of miscellaneous cases with aphasic manifestations, including cases of pseudo-bulbar palsy, arteriosclerotic dementia with right hemiparesis, Pick's disease, subarachnoid hemorrhage, and suspected brain tumor.

In all, 234 cases were examined. Another 80 were investigated briefly but not examined because they did not come within the limitations set for the test and control groups and showed no conditions of special interest. An analysis of the types of patient examined and the number in each of the subordinate groups is presented in Table II.

The problem of selecting the patients was not only that of obtaining clear-cut cases for the aphasic test group and for the two control groups, but that of securing adequate samples. So far as the aphasic group was concerned, different types of pathology were insured by selecting patients from both nervous and surgical services. The final group of 60 represents the large majority of the clear-cut cases of aphasia which were available for study over a period of four years. Inasmuch as the only uncomplicated cases not included were omitted because of time limitations, it is fair to say that the group presents a good cross-section of the clear-cut aphasic disorder. It must be noted, however, that this cross-section would be typical only for a city like Philadelphia to which a number of patients are sent for brain surgery.

A variety in educational, occupational, and social background was insured by studying aphasic patients in both city and private hospitals. The large majority of them were from the Philadelphia General Hospital, the Graduate Hospital of the University of Pennsylvania, and the Orthopedic Hospital and Infirmary for Nervous Diseases. In an effort to obtain control groups which would be comparable to the aphasic group, the patients with unilateral cerebral lesion but without aphasia and the normal adults were chosen from these three hospitals. The assumption underlying this choice was that the patients admitted to the surgical or orthopedic services of any one of these hospitals would be closely comparable in educational, occupational, and social classes to those admitted to the nervous wards. By and large, the authors believe that this assumption is valid, and consequently feel justified in evaluating the aphasic performances in terms of those of the normal adults.

TABLE II

ANALYSIS OF THE TOTAL GROUP OF PATIENTS STUDIED

Total number of cases investigated			*314*
Total number of cases examined			*234*
APHASIC PATIENTS SELECTED FOR TEST GROUP			60
CONTROL GROUP OF CASES OF UNILATERAL CEREBRAL LESION WITHOUT APHASIA			38
With history of speech difficulty		12	
Vascular with right hemiplegia	10		
Tumor in left hemisphere	2		
With no speech difficulty or history of it		26	
Vascular with right hemiplegia	4		
Vascular with left hemiplegia	19		
Tumor in right hemisphere	3		
CONTROL GROUP OF "NORMAL" ADULTS			85
MISCELLANEOUS CONTROL CASES			25
With cerebral lesions		14	
Miscellaneous, with aphasic manifestations	11		
Post-encephalitic Parkinsonismus	3		
With other neurological disturbances		11	
Multiple sclerosis	6		
Tabes dorsalis and spinal syphilis	5		
CASES EXAMINED BUT NOT INCLUDED IN TEST OR CONTROL GROUPS			26
Over age		5	
Foreign born		2	
Suggested as possibilities for aphasic group but found to show no aphasia		19	

It may seem a direct contradiction to say that the adults comprising the so-called normal group were surgical or orthopedic cases. Obviously such patients were not normal from every point of view or they would not have been found under hospital care. About 20 per cent of them were being treated for bone fractures or dislocations, 20 per cent for arthritis, another 20 per cent for gastro-intestinal conditions, and 12 per cent for hernia. The remaining patients included cases of burns, periostitis, osteomyelitis, and tuberculosis of the bone or joint. All were patients with minor illnesses which could fairly be said to have no effect on mental functioning, or patients who had made a good surgical recovery and were soon to be discharged from the hospital. It may justly be contended that factors which would affect reactions to the mental and educational achievement tests of the study remain even after a patient has made a good surgical recovery. Specific factors such as rapid fatigue were largely discounted because of the individual work with each patient and the fact that the examination was interrupted as soon as he became tired. Whether or not other factors resulting from the patient's abnormal physical condition actually affected responses to the tests cannot of course be proved. In the authors' opinion such factors, if they existed, were negligible, and the patients represent as satisfactory a sample of the middle levels of the normal adult population as could be obtained.

The possible effect of the physical injury or disease on the test responses is a relatively slight disadvantage in comparison with the advantages of the hospital group as a sample of the adult population. Mentally inferior adults may be studied in institutions for the feebleminded and mentally superior adults in college, but the large groups between these are not centralized in any organization. Unless all the adults of a community are to be studied, the population must be sampled in such a way as to give a good cross-section of the group as a whole. This sampling is probably more fairly carried out in the hospital than in any other group, for the only selective factor involved there, namely, an injury or disease necessitating hospital treatment, is not likely to be correlated with the abilities estimated by the tests.

2. COMPARATIVE DATA

While the aphasic group, the group of cases of unilateral cerebral lesion without aphasia, and the normal group are closely comparable, there are certain differences in their composition which must be noted. The aphasic group contains 11 semi-private and private patients, the control group of unilateral cerebral lesions without aphasia only one, and the group of normal adults none.[1] This difference widens the range of the aphasic group and raises its average, for most of the private patients were superior in educational, occupational, and social status. Secondly, there must be noted a factor which tends to lower the level of the aphasic group and also of the group with unilateral cerebral lesions but no aphasia. While the patients admitted to the nervous and to the surgical wards of the same hospital are closely comparable, the nervous group is probably somewhat below the surgical in social and financial status. The surgical and to a less extent the orthopedic groups represent the cases which must be hospitalized whatever the nature of the home environment. The nervous groups differ, particularly in the city hospitals, for they contain a large number of chronic cases which could be cared for in the home if relatives had the space, time, or money to provide the care. Thus there is a selective factor here operating to increase the representation of the lower classes in the nervous wards. As a result, the aphasic group and the group of patients with unilateral cerebral lesions but no aphasia contain a larger proportion of cases at the lower levels than does the normal group. In other words, they are neither of them such good samples of the population at large as is the normal group.

---

[1] Selected as they were from among ward cases, these normal adults of course represent only a sample of those classes of the population unable to pay for hospital care or able to pay only a small sum. They do not include adults so low grade in intelligence that they have had to be institutionalized nor do they include the upper financial classes able to pay as much as $4.50 a day for hospital care, and probably containing a larger proportion of persons of superior intelligence. In other words, the 85 adults of the normal group derive from the middle and lower middle classes of the population. They may fall slightly below the

Fortunately the normal group is the one where the goodness of the sample is most important. The results of the study of this group are not reported in detail in this volume, but they are used throughout as a basis for comparison. In general, as noted in the Introduction, the important comparisons are not between the whole group of aphasics and the normals; the interest lies rather in interpreting the individual aphasic's performance in terms of the normal. Consequently the fact that the aphasic group contains a few patients who are superior to those of the normal group, and that it also contains a larger number of the lower class patients, is relatively unimportant. In comparing aphasic patients of either higher or lower class with the normal median, allowance must be made for the differences which existed before the disorder; and such allowances will always have to be made until a very large number of normal adults have been studied so that different standards can be established for different levels

---

average of the urban population at large, but the facts as to their educational, occupational, and intellectual status, as discussed in Chapter II of *Adult Intelligence* (Weisenburg, Roe, and McBride), indicate that they come very close to the figures known for the population as a whole. They probably represent a sample of slightly higher educational and occupational status than would usually be secured from the hospital wards, for the study was made in the depression years 1930–1932 when many persons who would ordinarily occupy private or semi-private rooms were forced to enter the wards.

of education and experience. In relation to such a tremendous undertaking as this, the present research is merely breaking the ground. The goal set was simply the determination of the typical normal performance and the variability in performance which may be expected from a group of normal adults of the occupational and social classes forming the bulk of the population.

The group of patients with unilateral cerebral lesions but without aphasia resembles the aphasic group in that it probably contains too large a representation of the lower occupational and social classes; but unlike the aphasic group, it does not compensate for this overweighting at the lower end by including a number of private patients. Consequently its average is probably slightly below that for the population at large, a condition which must be taken into account in interpreting the results for this group.

These non-aphasic patients with unilateral cerebral lesions cannot be treated as a single group because some of them gave a history of speech difficulty and others had neither speech difficulty at the time of the examination nor history of it. Twelve of the thirty-eight cases were right-handed patients with neurological signs of lesions on the left and with history of speech difficulty; the remaining twenty-six were right-handed patients with no speech difficulty or history of it. Four of the latter group showed neurological signs of lesion in the left hemisphere; twenty-two showed neurological signs of lesion in the right. The twelve patients of the first group were presumably aphasic at one time. The four patients of the second group who showed no speech difficulty and neurological signs of lesion in the left hemisphere could have been considered with the cases of lesion in the right hemisphere without aphasia had the patients actually been studied from the onset and found to show no aphasia. Inasmuch as the lack of speech disturbance had to be judged from the hospital records, however, it seemed better to treat them separately. Both these groups of left-sided lesions with and without aphasia were small, and are not to be discussed separately. The important group in the present stage of the work is the larger group of right-sided lesions without speech difficulty or history of it. These left hemiplegic patients are perfect controls for the aphasic patients from the point of view of pathology, and their performances will be compared both with the aphasic and with the normal.

The data on age, education, occupation, sex, race, and hospital status for the three most important groups, the aphasic, those with right-sided lesions,

TABLE III

COMPARATIVE DATA ON THE APHASIC AND CONTROL GROUPS STUDIED

	APHASIA (N=60)	CONTROL CASES WITH RIGHT-SIDED CEREBRAL LESION AND NO APHASIA* (N=22)	NORMAL CONTROLS (N=85)
Age			
Median	44	48	37
Range	12 to 59	12 to 59	15 to 59
Years schooling			
Median	8†	6	7.5
Range	1 to 19+	0 to 8	0 to 16
Occupational rating			
Median (Barr scale)	7.5	5.3	7.7
Number of patients (Taussig scale)			
I. Professional	6	0	1
II. Semi-professional and business	9	2	15
III. Skilled labor	12	3	18
IV. Semi-skilled	16	8	27
V. Unskilled	7	8	6
Without vocation . . .	10	1	18
Sex: Number of patients			
Male	39	17	58
Female	21	5	27
Race: Number of patients			
White	50	11	70
Colored	10	11	15
Hospital status: Number of patients			
Private	7	1	0
Semi-private	4	0	0
Ward	49	21	85
Hospital: Number of patients			
Philadelphia General	20	11	30
Graduate	8	4	20
Orthopedic	10	3	35
Miscellaneous	22	4	0

---

* Vascular lesions (19) and tumors (3) of right hemisphere.

† This figure is probably slightly too high because the 8 cases whose education was "unknown" and therefore not used in computing it, were below rather than above average in social and occupational class.

TABLE IV

DATA ON THE SIXTY PATIENTS OF THE APHASIC GROUP

CASE NO.	SEX	RACE	AGE WHEN STUDY BEGAN	OCCUPATION	OCCUPATIONAL RATING		EDUCATION: YEARS' SCHOOLING	HANDEDNESS	TYPE OF LESION	TYPE OF APHASIA	HOSPITAL OR OTHER SOURCE	HOSPITAL STATUS
					Barr Scale	*Taussig Scale*						
1	M	C	44	Railroad porter	6.18*	IV	9	Right	Vascular	Receptive	Phila. Gen'l	Ward
2	M	W	32	Railroad laborer	3.99	V	4	Left	Tumor	Express.-Recept.	University	Ward
3	M	W	44	Machinist	7.05	IV	Unknown	Right	Vascular	Express.-Recept.	Phila. Gen'l	Ward
4	M	W	49	Professor	17.81	I	19 minimum	Right	Vascular	Expressive	Graduate	Private
5	F	W	38	Cloth inspector in mill	5.85*	IV	9	Right	Vascular	Expressive	Orthopedic	Semi-private
6	F	W	59	Housewife	–	–	6	Right	Vascular	Expressive	Graduate	Ward
7	M	W	35	Traveling salesman	11.17	II	9	Right	Tumor	Amnesic	Orthopedic and Graduate	Ward
8	M	W	34	Tool-maker	10.26	III	8	Right	Tumor	Express.-Recept.	University	Ward
9	M	W	42	Iceman	5.87	IV	Unknown	Right	Vascular	Express.-Recept.	Phila. Gen'l	Ward
10	F	W	57	Waitress	6.18	IV	3	Right, but can do many things with left	Vascular	Expressive	Compensation case	Ward†
11	M	W	37	Railroad laborer	3.99	V	6	Right	Tumor	Expressive	University	Ward
12	F	W	46	Tailoress	9.54	III	8	Right	Vascular	Express.-Recept.	Phila. Gen'l	Ward
13	M	W	21	Work in window screen factory	7.05	III	8	Right	Trauma (epilepsy)	Expressive	University	Ward
14	M	W	50	Laborer	3.62	V	5	Right	Vascular	Expressive	Phila. Gen'l	Ward
15	M	W	44	Truck-driver	6.46*	IV	8	Right	Vascular	Express.-Recept.	Phila. Gen'l	Ward

* Estimated.

† Probable hospital status of patients examined in their homes or in out-patient clinics.

TABLE IV (*cont.*)

CASE NO.	SEX	RACE	AGE WHEN STUDY BEGAN	OCCUPATION	OCCUPATIONAL RATING *Barr Scale*	*Taussig Scale*	EDUCATION: YEARS' SCHOOLING	HANDEDNESS	TYPE OF LESION	TYPE OF APHASIA	HOSPITAL OR OTHER SOURCE	HOSPITAL STATUS
16	M	W	40	Skilled mechanic	11.27*	III	12	Right, but fairly skilled with left because of injury to right	Vascular	Expressive	University	Ward
17	F	W	36	School-teacher	12.89	I	13	Right	Tumor	Amnesic	University	Semi-private
18	F	W	32	Housewife	–	–	7	Right	Tumor	Amnesic	University	Ward
19	M	W	39	Master mechanic	13.29	III	12 minimum	Right	Trauma	Express.-Recept.	Orthopedic	Ward
20	M	W	50	Teamster	5.41	IV	8	Right	Vascular	Expressive	Phila. Gen'l	Ward
21	M	W	50	Sailor; weaver	7.05	III	8	Right	Vascular	Expressive	Phila. Gen'l	Ward
22	M	W	57	Manager insurance office	12.41*	II	12	Right	Vascular	Receptive	Orthopedic	Semi-private
23	F	W	52	Superintendent apartment-house	11.00*	II	Unknown	Right	Vascular	Receptive	Phila. Gen'l	Ward
24	F	W	45	Glazer	7.44*	IV	6	Right	Vascular	Expressive	University	Ward
25	M	W	45	Salesman	9.72	II	7	Right but fairly skilled in use of left	Trauma	Expressive	University	Ward
26	M	W	44	Laborer	3.62	V	Unknown	Right	Vascular	Express.-Recept.	Phila. Gen'l	Ward
27	M	W	31	Sailor; mechanic	7.05	III	8	Right	Trauma	Express.-Recept.	University	Ward
28	M	W	44	Steam-fitter	8.75	III	8	Right	Vascular	Receptive	Univ. Clinic	Ward†
29	F	W	23	Stenographer	11.78	II	13	Right	Vascular	Expressive	Orthopedic	Private
30	F	C	32	Housework	6.18*	IV	4	Right	Vascular	Receptive	Phila. Gen'l	Ward

* Estimated.

† Probable hospital status of patients examined in their homes or in out-patient clinics.

TABLE IV (*cont.*)

CASE NO.	SEX	RACE	AGE WHEN STUDY BEGAN	OCCUPATION	OCCUPATIONAL RATING		EDUCATION: YEARS' SCHOOLING	HANDEDNESS	TYPE OF LESION	TYPE OF APHASIA	HOSPITAL OR OTHER SOURCE	HOSPITAL STATUS
					Barr Scale	*Taussig Scale*						
31	M	W	57	Lawyer	15.75	I	12	Right	Vascular	Receptive	Graduate and Orthopedic	Private
32	M	W	49	Civil engineer	15.43	I	16	Right	Vascular	Express.-Recept.	Phila. Gen'l	Ward
33	M	C	41	Night watchman and bootlegger	7.26*	IV	1	Right	Trauma	Expressive	Phila. Gen'l	Ward
34	M	W	27	Helper in garage	6.77	IV	7	Right	Tumor	Expressive	University	Ward
35	M	W	28	Research engineer	15.86	I	16	Right	Trauma	Receptive	Graduate	Private
36	F	W	45	Housewife	–	–	6	Right	Trauma	Receptive	Phila. Gen'l	Ward
37	M	C	48	Laborer	3.62	V	Unknown	Right	Vascular	Express.-Recept.	Phila. Gen'l	Ward
38	M	W	59	Detective	10.86	II	8	Right	Vascular	Receptive	Orthopedic Clinic	Ward†
39	M	W	13	School	–	–	8	Right	Vascular (epilepsy)	Expressive	Orthopedic	Ward
40	M	W	56	Weaver	7.05	III	6	Right	Vascular	Expressive	Phila. Gen'l	Ward
41	F	C	36	Housework	6.18*	IV	4	Right	Vascular	Expressive	Graduate	Ward
42	M	W	13	School	–	–	7	Right	Tumor	Amnesic	Johns Hopkins	Private
43	F	W	44	Housewife	–	–	7	Right	Vascular	Expressive	St. Joseph's	Semi-private
44	F	W	34	Clerk	11.34	II	13	Right	Tumor	Receptive	Orthopedic and Graduate	Ward
45	M	W	50	Sheet-metal worker	7.53*	III	6	Right	Vascular	Express.-Recept.	Presbyterian	Ward
46	M	W	58	Bank president	15.82*	I	16	Right	Vascular	Receptive	Orthopedic	Private
47	M	W	12	School	–	–	6 (4th grade)	Right	Tumor	Amnesic	Graduate	Ward

* Estimated.

† Probable hospital status of patients examined in their homes or in out-patient clinics.

TABLE IV (*cont.*)

CASE NO.	SEX	RACE	AGE WHEN STUDY BEGAN	OCCUPATION	OCCUPATIONAL RATING		EDUCATION: YEARS' SCHOOLING	HANDEDNESS	TYPE OF LESION	TYPE OF APHASIA	HOSPITAL OR OTHER SOURCE	HOSPITAL STATUS
					Barr Scale	*Taussig Scale*						
48	F	W	32	Housewife	–	–	7	Right	Tumor	Expressive	Orthopedic and University	Ward
49	M	W	43	Milkman	5.87	IV	6	Left	Tumor	Expressive	Temple	Ward
50	F	W	33	Bookkeeper	11.34	II	10	Right	Vascular	Expressive	St. Joseph's	Ward
51	M	C	28	Laborer	3.62	V	Unknown	Right	Trauma	Expressive	Phila. Gen'l	Ward
52	F	C	51	Housework	6.18*	IV	5	Right	Vascular	Receptive	Phila. Gen'l	Ward
53	M	W	44	Bartender	5.27	IV	8	Right	Vascular	Expressive	Phila. Gen'l	Ward
54	F	C	27	Housework	6.18*	IV	4	Right	Vascular	Receptive	Penna. Clinic	Ward†
55	F	W	26	Housewife	–	–	6	Right	Vascular	Expressive	Penna. Clinic	Ward†
56	M	C	45	Barber	6.92	III	Unknown	Right	Vascular	Receptive	Penna. Clinic	Ward†
57	M	C	43	Laborer	3.62	V	Unknown	Right	Vascular	Expressive	Phila. Gen'l	Ward
58	M	W	49	Butcher	7.79	III	8	Right	Tumor (suspect)	Receptive	Graduate	Ward
59	F	W	59	School-teacher	12.89	II	12	Right	Tumor	Expressive	Graduate	Private
60	F	W	51	Housewife	–	–	10	Left except for writing and sewing	Tumor	Receptive	University	Ward

* Estimated.

† Probable hospital status of patients examined in their homes or in out-patient clinics.

and the normal, are presented in Table III. A comparison of the figures in the three columns will show the relatively broad educational and occupational ranges among the aphasic patients, which have been discussed above, and the slightly low educational and occupational medians for the control group of right-sided lesions. Furthermore, this group contains a higher proportion of colored than do either of the other groups. It will be evident, however, that the aphasic and the normal groups are very similar.

3. THE APHASIC GROUP

From the point of view of the aphasia study, the interest is so largely in the individual patient that the important facts are presented for each case separately in Table IV. Summary statistics for the group appear in Table III. The men outnumber the women (39 to 21). The median age for the men is the same as that for the total group, 44 years; for the women 38 years. The white far outnumber the colored (50 to 10). The median age for the white is 44, and for the colored 42. The distribution on the basis of the pathological condition is as follows:

	Number	*Median age*
Vascular cases	37	45
Tumor cases (14 operated)	15	35
Traumatic cases (7 operated)	8	35

4. SUMMARY

Of a total of 234 patients examined, 167 are included in the three main groups: 60 in the clear-cut aphasia group, 22 in the control group of patients with right-sided lesions and without aphasia, and 85 in the control group of normal adults.

General statistics for these three groups are presented in Table III. The aphasic group includes vascular, tumor, and traumatic cases and is probably a fair sample of clear-cut aphasic disorders. It is composed of patients of a wide variety of educational and occupational levels, with averages which approximate those of the group of normal adults. The so-called normal control cases were selected from the surgical and orthopedic wards of the hospitals in which the majority of the aphasic patients were studied.

Their distributions with regard to education and occupation indicate that they represent a good sample of the groups around the average in the population at large.

From the point of view of pathology the patients with right-sided lesions and without aphasia are excellent controls for the aphasic patients. The group is relatively small, however, and is slightly below the averages of the aphasic and normal control groups in educational and occupational status.

VI

TESTS AND EXAMINATION METHODS USED

1. Psychological examinations for aphasic patients: a discussion of the essential requirements
2. Outline of the principal tests
3. Discussion of general method
4. Summary

1. PSYCHOLOGICAL EXAMINATIONS FOR APHASIC PATIENTS: A DISCUSSION OF THE ESSENTIAL REQUIREMENTS

THE complexity, the extent, and the variations in the aphasic disorder make the problem of examination difficult. It is necessary to select tests for a wide variety of performances, far more than would ordinarily be studied in making a mental examination. Because of the great variations between individuals, however, the tests which are most useful for one case may be least interesting for another. In the construction of a test battery, therefore, the most satisfactory system seems to be the arrangement of a group of tests to cover all the performances which may be disturbed, together with the provision for further more detailed studies of those performances which show the greatest or most interesting changes.

Research in aphasia has long been handicapped by the variations in the examination methods used by different investigators. Many of these differences depend on fundamental disagreements of a theoretical nature and thus cannot be avoided, but others are obviously unnecessary. Most of the tests selected as a preliminary examination could be standard, so that to this point the results obtained by one investigator could be compared with those obtained by another. Undoubtedly some of the detailed studies arranged for thorough analysis of a specific disturbance could also be standardized. But, however great the effort for standardization, examinations for aphasia can never be routine procedures, for not only must particular tests be added to analyze specific disturbances, but the standard tests must sometimes be altered to throw more light on unusual difficulties.

It cannot be too greatly emphasized that the examination of an aphasic patient is first of all a matter of qualitative study, with a view to determining his methods of work, the causes for his failures and the nature of the responses he finally achieves. Therefore the fundamental requirement of any test is that it provide for a satisfactory analysis of the performance in question. In this regard the best tests are usually the least complicated, that is, the tests which bring one performance into focus and enable the examiner to define the changes which have appeared in that performance.[1]

A special instance of the need for qualitative study arises from the effect which specific language disturbances may have on different performances. Defects in expression, for example, may make it hard to determine how much the patient has understood. In view of this situation tests must be arranged to differentiate between the quality of the comprehension and the quality of the response. In other words, studies of expression in speech or writing must be independent of the extent to which the patient has understood, and studies of comprehension must involve responses such as checking a word or drawing a line which are as little as possible influenced by the patient's expressive defects.

Another problem which the aphasia study raises is the determination of the relative success in the two expressive processes of speaking and writing, and in the two receptive functions of understanding spoken language and printed material. To meet the requirement here various tests must be arranged which will check the oral and the written response to similar problems, and others which will estimate the quality of the performance when the material is presented orally or in print.

Still another problem arises from the possibility that in aphasia as in other pathological conditions, there may be a variability greater than normal. A sufficient number of items must therefore be included in every test to determine the average performance. Furthermore, the same test or an equivalent form of the test must often be given at intervals as a measure of improvement or deterioration, or as a check on the variations in performance from day to day.

---

[1] In this discussion of the requirements of a good test for use in aphasia the particular conditions surveyed are those introduced by the aphasic disorder; the usual requirements laid down for the selection of tests for normal persons are not adequate here. An example will make the situation clear. One of the most fundamental requirements of a test is that it be valid, that is, that it actually test what it purports to test; but even when a test has been shown to be valid for normal persons, it does not necessarily follow that it is valid for aphasics. A sentence completion test, for instance, may be a valid test of intelligence for normal persons above a certain mental age, and it may also be a valid test of intelligence for some aphasic patients, but for others who have severe reading difficulty, it becomes a reading test. Validity cannot usually be determined for aphasic patients as a group, and since objective criteria of validity are lacking, it is therefore all the more important in examining for aphasia that the test provide for an analytic study of performance.

Not only are aphasic disturbances varied in nature, but they differ greatly in severity. To provide for study of all degrees of disturbance, therefore, a satisfactory battery must include easy as well as difficult tests. So far as possible, it is advisable to arrange for graded tests within each type of performance, for example, reading tests which will estimate all degrees of disturbance from the most marked to the slightest. To a certain extent, however, the type of performance as well as the difficulty of the performance must differ when different levels of ability are investigated, for as the level changes the types of performance which the patient can attempt also change.

2. OUTLINE OF THE PRINCIPAL TESTS

To make the extensive survey of mental functioning in aphasia which was the chief object of this research, a wide variety of tests were chosen. The large majority of them were the mental and educational achievement tests which have been found useful for children.[2] The knowledge of the child's performances on these tests, although in some cases fairly thorough, was not a satisfactory basis on which to interpret the findings for aphasic patients because it was obvious that the normal adult's performance might differ considerably from the child's, not only in the degree to which he could solve the various problems but in the nature of his solution. All but the simplest speech tests chosen for the aphasic battery were therefore given to normal adults and the typical adult performance, the variability in that performance, and the nature of that performance determined. The aphasic responses were then interpreted in terms of the normal adult performances, and are always so expressed in this book.

---

[2] Almost the only available tests constructed for adults are the Army Alpha and Beta and the various college entrance examinations. None of these were sufficiently comprehensive for the aphasia study, nor suitable for a qualitative analysis of the aphasic changes. Moreover, the college entrance examinations were of course too difficult. To obtain satisfactory tests, it was therefore necessary to turn to those devised for children. Among these an attempt was made to select those which would be suitable or at least not objectionable from the point of view of adult interests. Naturally, however, it was almost impossible to find material in the easiest tests which would really be suitable for a mature mind. More satisfactory tests could be constructed specifically for adults, but the time and expense would hardly be worth while; for the majority of those patients whose disorders are severe, and consequently those who must take the easiest tests, do not object to the childish content.

TABLE V

OUTLINE OF THE PRINCIPAL TESTS

SPEAKING

- Records of spontaneous speech and reactive responses
- Automatic word series: saying days of week and months of year; saying the alphabet; reciting a prayer or poem

NAMING

- Naming of standard objects, colors, and line drawings

REPEATING

- Words containing all English sounds, and short familiar phrases and sentences

UNDERSTANDING SPOKEN LANGUAGE

- Response to everyday questions and comments
- Comprehension of words and sentences, as shown by response to Gates Word, Phrase, and Sentence Reading Test, read aloud to the patient
- Response to Test of Following Directions
- Response to tests involving the comprehension of spatial terms and relationships, including Head's Hand, Ear, and Eye Test and the Abelson Geometrical Figures Test

READING

- Oral: Gates Word Pronunciation Test
- Gray Oral Reading Paragraphs
- Reading comprehension: Gates Primary Reading Tests
- Chapman Unspeeded Reading-Comprehension Test
- Thorndike McCall Reading Scale

WRITING

- Records of spontaneous writing
- Writing to dictation
  - Word dictation: Morrison McCall Spelling Scale
  - Sentence dictation: Stanford Achievement Dictation Test
- Oral Spelling: List of words from Gates
- Copying: Standard paragraph

ARITHMETIC

- Computations: Stanford Achievement Arithmetic Computation Test
- Problems: Stanford Achievement Arithmetic Reasoning Test

TABLE V (*cont.*)

LANGUAGE INTELLIGENCE TESTS

- Controlled Association Tests
  - Opposites
  - Mixed Analogies
- Sentence Completion Test: Kelley Trabue Completion Exercises
- Absurdities
- Vocabulary
  - Oral: Stanford Binet Vocabulary Test
  - Printed: Thorndike Test of Word Knowledge

REPRODUCTION OF VERBAL MATERIAL

- Reproduction of digit and letter sequences, series of nonsense syllables, disconnected words, sentences, and a short story

NON-LANGUAGE TESTS

- Formboards, imitation tests, digit-symbol substitution tests, drawing and picture completions and reconstructions: Pintner Paterson Performance Scale and Pintner Non-Language Mental Test
- Drawing
  - Figures reproduced immediately after presentation
  - From model: drawing of a chair
  - Drawing of a man scored on the Goodenough Scale

The principal tests are outlined in Table V. The first four sections include records of the ordinary language facility which all normal or near-normal persons attain. The next three sections include tests of achievement in the fundamental branches of reading, writing, spelling, and arithmetic. These tests require performances which the majority of literate adults are expected to have fairly well in command, while the language intelligence tests of the following section involve performances which are supposed to vary more directly with intelligence. Naturally the achievement tests also depend on intellectual ability. There are no tests of language performances which do not, and consequently there is no way of testing for aphasic disturbances without taking account of the intellectual level. After the language intelligence tests, are listed the "memory" tests, which are also verbal, and then the various non-language intelligence tests. The latter of course overlap the language intelligence tests to some extent, not only because some of the so-called non-language tests actually require verbal directions but also because many of them undoubtedly involve a certain amount of language formulation in the patient's solution.

The individual tests outlined in Table V and the techniques employed in administering them are discussed in Appendix II. Shorter batteries of tests, which cover the most important performances but are sufficiently brief to be practical for general diagnostic purposes, are also presented in this appendix.

3. DISCUSSION OF GENERAL METHOD

In the study of aphasia as in any other study, the value of the test findings depends on how good indices these findings are of the patient's real ability. Consequently, except in a few instances when it was necessary to see what the patient could do under difficult conditions, a great effort was made to bring out his best work. This goal was achieved, first, by providing conditions suitable for good work, i.e., quiet, absence of fatigue, and comparative comfort and freedom from anxiety; and second, by securing the patient's cooperation.

Satisfactory external conditions were almost always secured, for the staffs in the various hospitals were most helpful in providing separate rooms or cubicles where the work could be done. In most cases, too, the patients themselves were in good working condition. Sometimes, however, tests had to be given under unfavorable conditions. For example, in some of the tumor cases tests were made just before the patient was operated, and consequently at a time when he was in considerable anxiety or pain. Results obtained under such conditions were never compared directly with those obtained under more satisfactory conditions.

With a suitable approach most of the aphasic patients cooperated very willingly. The less intelligent patients were usually gratified by the particular attention they were receiving, while the more intelligent were interested in the examinations and their purpose. No difficulty was ever experienced in securing the patient's maximum effort when he could be shown the value of the examinations in diagnosis or as a preliminary step in reeducation. The only difficulty arose in connection with those patients who were seriously depressed, or with those who showed personality changes and, usually, a marked lack of insight into the disorder.

The consciousness of a speech disturbance and the hope of alleviating it, which formed the basis of cooperation for the aphasic patients, were factors which of course did not operate for the patients with unilateral cerebral lesion but no aphasia or for the so-called normal adults. Consequently a different approach had to be used for these patients. They were told that a study was being made of patients who had difficulty in speaking, reading, or writing as a result of a "stroke" or brain injury, and that little could be done for these patients until the normal methods of work were determined. They were then asked to take the series of tests to show how the normal person worked and what he could do. Some of them responded on an altruistic basis, being willing to do something which would help others; a good many accepted the proposition because the tests would fill in spare time in the hospital.[3] In general all those who agreed to take the examinations worked seriously and well, exerting great effort on all the tasks which they were asked to attempt.

It is hardly necessary to say that the qualitative study of performance required individual work with the aphasic patients and with all others who might be expected to show any abnormal condition. Even those tests which are usually given to groups were administered individually, and this procedure was followed with the normal adults as well.

In working with the aphasics and with most of the other pathological cases the examiners made as nearly complete records as possible, noting down the patient's behavior in detail and recording his verbal responses, whether in connection with the tests or with other situations. Often a complete record of the verbal responses could be obtained. When the patient's speech was too fluent for this, however, care was taken to record the most interesting sections of his speech *verbatim*, using spelling which would indicate his pronunciation.[4] The point is important: the interest lies not only in the content of the patient's speech but in its particular characteristics—forms of expression, sentence structure, verbal formation and usage, articulation, and so forth. A satisfactory speech record is often of service in interpreting the nature of the patient's performance on a test. Close observation of gestures is equally important, for patients sometimes attempt to express by gestures what they cannot express verbally. Furthermore, the records of speech and of the non-verbal responses must be analyzed together, for it sometimes happens that one process facilitates the other.

---

[3] None of the patients with cerebral lesions refused to take the examinations, and only 21 per cent of the "normal" adults who were approached, refused. This percentage is low in comparison to those found by other investigators who have made studies of adult intelligence.

[4] When pronunciation is much affected, or rhythm, accent, or voice tone is changed, the most satisfactory studies are of course made by phonographic or other records which can later be reproduced for analysis. If such records cannot be made without disturbing the patient, as they often cannot in the hospital situation, it would probably be more accurate to record the patient's speech by the International Phonetic System. Unfortunately the examiners could not write quickly by this system and were therefore unable to use it.

As a result of the individual work, the large number of essential tests, and the additional studies which had to be included for particular difficulties, each examination naturally required a great deal of time. The time was further increased because of the frequent, and very valuable, conversations with the patient on matters of general and personal interest. For some of the aphasic patients where reeducation was attempted, the total number of hours was as high as 94. The medium number of hours spent in the study of the aphasic patients was 9; the average, 19. In many cases, as reported in Chapter XV, examinations were repeated at intervals over long periods of time. On the average the pathological cases without aphasia required slightly more time than the aphasics, because, having no marked language disturbances, they were able to attempt more tests. The normal adults required an average of 10 to 15 hours. It must be noted that most of the aphasia studies were very thorough, and that the simplified examinations outlined in Appendix II would take only two or three hours.

The working periods varied from ten or fifteen minutes to an hour in length, with the duration adapted to the condition of the individual patient. Except in rare instances when examinations had to be completed in a limited time, work was stopped at the first signs of fatigue.

4. SUMMARY

The complexity and the variations in aphasic disorders lead to a number of particular requirements in the construction of a test battery, the most important of which are: 1) the selection of a large number and variety of tests to cover all the performances which may be affected; 2) the provision of further tests for detailed study of particular disturbances; 3) the selection of tests which will make possible a qualitative analysis of the performance, enabling the examiner to study the relative importance of the specific speech defect and the other changes, the patient's method of work, and so forth.

The principal tests selected for this research, which are outlined in Table V, are for the most part mental and educational tests which have proved useful for children. The results for the aphasic patients are not, however, interpreted on the basis of the known results for children, but on the basis of performances of a comparable group of adults chosen and examined for this particular purpose. The principal tests, other supplementary tests, and simplified batteries of tests for ordinary diagnostic purposes are discussed in Appendix II.

VII

A CLASSIFICATION OF TYPES OF APHASIA

1. The problem of classification
2. The classification adopted
    The predominantly expressive group
    The predominantly receptive group
    The expressive-receptive group
    The amnesic group
3. Summary

1. THE PROBLEM OF CLASSIFICATION

STUDIES of aphasic patients on the basis of tests described in the previous chapter repeatedly demonstrate the complexity of the disorder. When the language process has broken down, the specific disturbances appear in a number of forms of language: speaking, understanding spoken language, reading and grasping the meaning of printed material, writing, and so forth. They affect higher language performances, that is, a variety of performances taking place on the basis of expressive and receptive functions and involving "intelligent" thinking in language terms. These higher language performances, furthermore, do not always suffer directly in the sphere of the expressive and receptive functions; they are sometimes affected when the specific expressive and receptive processes are apparently satisfactory. In such cases the failure, like that of a normal person in a similar situation, is an evidence of inadequate intelligence. The failure need not, however, mean that the patient is incapable of any high-grade mental functioning. He may do very well in performances which demand intelligent behavior, but are not directly dependent upon language. Another patient may, on the contrary, fail in a variety of language and non-language performances in such a way as to indicate a basic change of mental functioning. In his case the disorder goes beyond the language process.

It is clear that the term "aphasia," if it is to be preserved as tradition would suggest, must then be understood to include a variety of psychological changes occurring with a unilateral cerebral lesion and appearing chiefly but not altogether in language processes. In some few cases the disturbances, in so far as they can be determined by tests after the attack, are confined to language performances; in many, non-language performances are affected to a slighter degree than the language; in another group, language and non-language performances alike seem to suffer in consequence of a basic change in mental functioning.

The problem of classification is therefore exceedingly complicated. Apart from anatomical or physiological considerations, it would be possible to make more than one classification on a purely psychological basis. An obvious basis immediately presents itself in the form of language most seriously affected, i.e., speaking, understanding spoken language, reading, and so forth. This grouping would continue the classical types "aphemia," "word-deafness," "alexia," and "agraphia." These terms have been useful in the past as convenient names for outstanding symptoms, but they have been misleading whenever they have been taken to indicate isolated types of disorder. In this sense they invariably mask the true complexity of the aphasic changes. The names are so definite and restricted that they immediately connote some loss in one form of language. Actually such specific loss does not occur. The terms, on the one hand, hide the true condition in those cases where one form of language, writing for instance, is indeed affected more seriously than any other, but in consequence of a more general disorder of mental functioning which is manifested in non-language performances as well. On the other hand, these terms are extremely unsatisfactory in the vast majority of cases where the disorder is not manifested in one but in many or all forms of language. One of the terms will not then suffice and several must be used to cover the various outstanding symptoms. For example, if in addition to other less prominent changes, a patient shows marked disturbances in understanding spoken words and marked disturbances in reading and understanding printed material, he might be described as a case of "word-deafness" and "alexia." The two terms, however, fail to indicate the relationship of the disturbances or to admit of changes in other language processes. They lead to a simplification which is not in accordance with the facts.

When the language process breaks down, the extremely complicated condition which results is a natural consequence of the complexity of the process as a whole, of the close functional interrelationships of various parts of this process in the course of their development and in their habitual service, and of the extent to which language processes have permeated and enriched all mental functioning. The complexity, however, is not without order, and it is on the basis of this observed order that any classification must be made. Groups of disorders cannot be differentiated logically but must form themselves, as it were, when a sufficient number of cases have been examined in thorough and comparable fashion. When formed, they might well be designated, as Head once suggested, as "a," "b," "c," or "d" types. They would thus be free of the misinterpretation likely to arise from the names assigned to them, for there is no convenient designation which represents the complexity of any disorder or the extent to which disturbances of one group overlap those of another.

2. THE CLASSIFICATION ADOPTED

As the aphasic patients were studied it became clear that they fell into three large classes: the *predominantly expressive* where the most serious disturbances were in expression in speech or writing; the *predominantly receptive* where receptive processes suffered more than the expressive, and the changes in speaking and writing were mostly of a different nature from those of the expressive disorder, and the *expressive-receptive* group where all language processes were extremely limited. This threefold division was admirable in its simplicity and logic. It did not quite conform to the facts, however, for it required the inclusion within the predominantly expressive group of two different kinds of disorders. On the one hand, there were those patients whose expression in speaking was limited because of defective articulation and word-formation and in writing because of spelling errors and gross changes in the formation of the word. These patients, handicapped in various degrees by many other disturbances, were the typical expressive patients. On the other hand, there were a smaller number of patients whose expression was disturbed not by defects in word-formation, but by difficulties in evoking words as names for objects, conditions, or qualities. Logically patients of this type belonged to the predominantly expressive group. Psychologically, however, their disorder was so different in nature that they could not well be classified with that group. Neither did they belong to the predominantly receptive group, for their understanding remained always relatively superior. A fourth group was therefore created, and designated as the *amnesic*. The term is well established in the literature on aphasia and it is a satisfactory description of the particular language difficulty.

Every rough classification which implies too great simplification has its disadvantages, and this fourfold division of the aphasic disorders is no exception. It is of practical value only when its disadvantages are thoroughly clear. In the first place, it must be emphasized that none of the terms is other than descriptive and that none does more than point out the most marked characteristics of the case. Neither the patients of the expressive nor those of the receptive group are handicapped solely in expressive functions or solely in receptive. The disorders are only *predominantly* expressive or receptive; the other processes in either case are always more or less affected, as are language and sometimes non-language performances involving intelligent thinking on a higher level than the specific expressive or receptive functions. Similarly in the amnesic group, while the fundamental difficulty is in the production of words as names, there may be occasional defects in the form of the words produced and there is always some disturbance in the understanding of spoken language or printed material. Furthermore, although the term "expressive-receptive" is a satisfactory designation for the disorders of that group, it does not indicate the varying degrees of disturbance in the non-language field.

A second disadvantage arises in connection with the receptive disorder. The disturbances of this group include not only limitations in the understanding of spoken language and of printed material but characteristic difficulties in expression and confusions in words and grammatical forms and structures which may be prominent. When they are prominent, the patient's expression in language may be so seriously disturbed that the term "predominantly receptive" is true only by a hair's breadth, or even loses its logical justification altogether. Nevertheless, even if expression is seriously disturbed, the expressive disturbances which consist of verbal and grammatical confusions and the limitations in understanding belong together. They represent one of the principal types of disintegration in the language process. The name to be assigned to them is a minor point and the term "receptive" has been adopted because the limitations in understanding are almost always more prominent in relation to the disturbances in speaking or writing than is the case in the predominantly expressive disorders.

The Predominantly Expressive Group

The predominantly expressive disorders are the most numerous with 43.3 per cent or 26 cases. The group is a homogeneous one in that it is comprised of patients whose most serious disturbances are in speaking or writing or in both forms of language expression. On other counts, however, it is heterogeneous. It includes cases differing widely in the severity of the disorder, where the changes range from slight defects and limitations to an almost complete loss of expression in speaking or writing. It includes cases which differ greatly in the extent of the disorder, for some patients show most marked disturbances in the executive mechanisms of language expression, others more general language disturbances which are still predominantly expressive, and others changes in mental functioning which are manifested alike in language and non-language performances. While these differences in the extent of the disorder are not such as to permit of rigid subdivisions within the expressive group as a whole, it is possible to select a case to typify the relatively simple change where defects in articulation and word-formation are more marked than limitations in receptive functions or higher language performances, and another case to represent those where a more general change in mental functioning has had far-reaching effects on language and non-language performances. Such illustrative cases are reported in the chapter on the expressive type of disorder. It is also possible to illustrate by a characteristic example the more complex language disorder where receptive functions are decidedly limited but still not so seriously affected as the expressive, and to describe the disturbances in the comparatively rare cases in which one form of expression is much more seriously affected than the other. None of these differences in the extent of the disorder or in the expressive process which suffers most damage represents a distinct type of aphasia. Each one is rather an example of one of the conditions which result when the language process in breaking down leaves a predominantly expressive disorder.

The Predominantly Receptive Group

Predominantly receptive disorders were found in a relatively small number of cases, 28.3 per cent or 17 patients. The receptive, like the expressive group is heterogeneous, with differences in the severity of the disturbances, in the receptive process most seriously affected and in the relative prominence of limitations in receptive functions and of disturbances in expression. Typical differences are discussed in detail in the chapter on the receptive type of aphasia, and illustrated by case records. Expression in speech or writing, which was more or less affected in every case examined, was often handicapped as in the amnesic and in some expressive disorders, by difficulty in evoking words as names. The other changes in expression were of a different nature from those characteristic of the expressive disorders: verbal confusions were more frequent than errors in word-formation; sentence construction was often awkward or actually erroneous; and a fairly free and rapid speech contrasted with the retarded and difficult speech of the typical expressive cases.

The Expressive-Receptive Group

Twelve of the patients or 20 per cent showed very serious limitations in all language performances. Although they were often slightly more able in one form of language expression or reception than in the other, expressive and receptive processes were on the whole so equally affected that no differentiation could be made between them. The cases differed widely only in the quality of the non-language performances. While these were always slightly superior to the language, the difference was small in some cases and large in others. Five of the patients reached or exceeded the normal medians on some of the non-language tests. Thus the only differentiation possible within the expressive-receptive group is that according to the quality of the non-language performances, and on this criterion the patients do not fall into separate classes but rather extend over a wide range from low to high.

The Amnesic Group

The amnesic group includes only 5 cases or 8.3 per cent of the total. While comparatively rare, the disorder is nevertheless a clear one. The fundamental difficulty in evoking words as names for objects, conditions, or qualities leads to serious limitation in speaking and writing and characteristic disturbances in other language performances. The expressive disturbances differ from those of the predominantly expressive group in that the speech is freely and accurately articulated, but hesitant and fragmentary because of the many words which the patient cannot evoke. He can almost always recognize the correct word and select it from a series suggested to him. Furthermore, receptive functions are relatively satisfactory.

3. SUMMARY

Classification of aphasic disorders is extremely difficult because of the complexity and variety of the conditions which result when language processes break down. Disorders sometimes affect a specific form of language more seriously than any other, sometimes lead to extensive disturbances within the language process as a whole, and sometimes through a basic change in mental functioning bring about disturbances in a variety of related language and non-language performances.

The most satisfactory classification of types of aphasia is not a logical but an empirical one. The disorders revealed by extensive study of more than sixty aphasic patients fell into four main groups, which were designated respectively by the descriptive terms "expressive," "receptive," "expressive-receptive," and "amnesic." Each term is an indication of the most marked disturbances characteristic of the group.

The predominantly expressive group, the largest, is comprised of patients who show defects in the articulation and formation of words with more or less pronounced limitations in receptive functions, in higher language performances, and in various activities requiring intelligent behavior but not directly dependent upon language.

The predominantly receptive patients differ from the predominantly expressive in their relatively more serious limitations in the understanding of spoken language or of printed material, and in the nature of their disturbances in expression. The latter are chiefly verbal and grammatical confusions.

The expressive-receptive group includes those patients whose language functions are all severely and more or less equally limited. Non-language performances in these cases are usually only slightly above the level of the language, but they are sometimes far superior to the language.

The fourth group, the amnesic, is the smallest, but is nevertheless a clear type of aphasia. Difficulties in expression in this group are not like those of the expressive disorder, but result almost entirely from inability to evoke necessary words as names for objects, conditions, or qualities. Receptive functions are relatively satisfactory.

VIII

TYPES OF APHASIA: THE EXPRESSIVE

1. The nature of the expressive disorders
2. A simple disorder: Case No. 33
3. A more complex disorder: Case No. 4
4. Other variations within the expressive disorders: Cases Nos. 50 and 6
5. A complex disorder with severe disturbances in writing: Case No. 16
6. Summary

1. THE NATURE OF THE EXPRESSIVE DISORDERS

WHEN language processes are disturbed, the changes in language expression differ in nature as well as in severity. Qualitatively they fall into three main groups: defects in the articulation and formation of words and sometimes simplifications in the structure of the sentence; confusions in words or grammatical forms; and difficulties in the evocation of words as names for objects, conditions, or qualities. The first group of changes are the characteristic disturbances of "predominantly expressive" aphasia, where receptive functions are relatively satisfactory. The second group, which are just as clearly disturbances in expression, are nevertheless more characteristic of the "predominantly receptive" aphasia as defined above and are reserved for discussion with this type of disorder. The third group, the difficulties in evoking words as names, constitute the fundamental disturbance in amnesic aphasia, but amnesic difficulties may also appear in predominantly expressive disorders and are often marked in predominantly receptive.

The disturbances characteristic of the predominantly expressive disorder may appear in any degree of severity from a slightly abbreviated speech with occasional mispronunciations to an almost complete loss of all forms of spoken response. Particularly in the early stages, the disorder may be so severe that the patient is able to produce only a few words or sound combinations. If his propositional expression is altogether gone, he may still have some use of words in emotional or automatic responses. The emotional responses, arising as they do from the patient's emotional reaction to the situation, include not only swearing but a variety of expressions of joy or grief or other emotional states. The automatic responses include, first, the forms of speaking which have become more or less well learned, notably "automatic word series" like the number series, the days of the week, and so forth. Second, they include a wide variety of verbal responses which are like the emotional expressions in that they arise from the total situation in which the patient finds himself. In relation to the "automatic" responses like counting, these are better designated as "reactive" forms of speaking, for their appearance and their superiority to propositional statements depend not so much on the fact that they have through years of experience become automatic, as on their issue as integral parts of the patient's reaction to some more or less pressing situation. Thus the patient may not only say "Hello" or "Good-bye" in appropriate circumstances, but he may bring forth a much more complicated propositional response than he could produce without the stimulation of the immediate situation. For example, in one case where speech was extremely limited and hard to understand because of difficulties and errors in the formation of words, the patient one day startled the examiner by saying suddenly and clearly: "Shut de door . . . izz a draught at my leg!" In this case as in many others the reactive expression was not only more extensive than the propositional, but it was more clearly articulated.

In the predominantly expressive disorders speech is almost always retarded. The rate of speaking in any one case is rarely constant, but varies with the nature of the speech problem; it is usually increased in the automatic performances and also in reading aloud. It varies, too, according to the patient's condition, his alertness, his interest, and so forth. The retardation depends to some extent, as it does in the amnesic syndrome, on poverty of words and inability to evoke the necessary word quickly, but for the most part it results from a difficulty in producing the correct word-form and carrying through the necessary articulatory mechanisms. It is probable, however, that other causal factors may operate in some cases, for occasionally speech remains greatly retarded even after it has become fairly satisfactory from the point of view of articulation and word-production.

A certain number of predominantly expressive patients not only have difficulty in producing sounds, but speak monotonously, without normal accent and inflection. There is no regular correspondence between the extent of this disturbance in the musical qualities of speech and the extent of the disturbance in language expression. Often patients who can use but one or two phrases, which may be only stereotyped combinations of word-sounds, nevertheless inflect these phrases with much of the accent and variations of pitch characteristic of normal speaking.

Analysis of the actual defects of speaking in a number of predominantly expressive cases shows many variations in severity and in type. There are all degrees of disturbance from slight mispronunciations of individual sounds to gross changes in the structure of the word. In general the simple mispronunciations are more characteristic of the slighter disorders and the gross changes more characteristic of the severe disorders, but there are no regular gradations.

The most valuable study is of course that of the individual patient, with an analysis of the extent of the disturbance shown in certain situations, the nature of the errors in articulation and word-formation, and the relation of these to the concept of word-form. Nevertheless, a few summary statements may be made as to the nature of typical defects. In some cases speaking is slurred as if the mechanisms of speech production were not carried through with sufficient precision. Usually instead of a poor quality of the sounds and their combinations, or perhaps in addition to this defect, there are actual errors in articulation where one sound is substituted for another. The patient, for instance, says "*h*asket" for "basket," or "*j*air" for "chair" or "br*ints*" for "bridge." Some of the sounds confused are similar in formation like "ch" and "j" and some, like "b" and "h," are quite different. In a few cases the patient tends to substitute one sound, for instance "s," for many others as if the specific mechanism for that sound were the simplest and most ready. Unless certain speech muscles suffer from some degree of paralysis, there are usually no regular difficulties with particular sounds. A sound badly failed in one setting may be well articulated in another. Its accuracy does not by any means depend only on the mechanical ease of the word or phrase in which it appears, but varies with a number of facilitating factors, such as emotional excitement or personal interest or familiarity with the material, and also with the nature of the general and speech situation involved. As for speech errors in normal persons, the total word or phrase in which the sound appears may not only affect the ease with which it can be produced, but may determine the substitutions made for it.

After producing a sound or word badly a patient of the predominantly expressive type often realizes that there has been an error and attempts to improve his performance. The question always arises as to how accurate is his appreciation of the error and his concept of the correct sound- or word-form. Again many variations appear, not only between cases but within any one case. Some errors are simple mispronunciations such as the slips a normal person makes and are as readily corrected. Others involve more serious lack of control of the executive speech mechanisms, resulting either in complete failure to produce the sound or in initial failure followed by repeated attempts and final success. In the first case, the complete failure may occur when the patient has an exact knowledge of the structure of the word, as shown for instance by his spelling it aloud correctly.[1] His difficulty then lies in the mechanisms of speech production. In the case of those patients who recognize the initial failure, and after many attempts finally produce the word correctly, the striking defect is again in the control of the executive speech mechanisms, and the patient may have a good concept of the word-form. For example, he may say "aminal" over and over again, but finally bring out "animal" correctly. Usually in such a case his correct response comes after relaxation and a new start, or after he has broken the word up, either by spelling or by separating the syllables.

In addition to these relatively simple defects which seem to lie altogether in the mechanisms of speech production, there are usually more complicated disturbances involving both difficulty in the production of sounds and unsatisfactory concepts of the sound- or word-form. Sometimes the patient not only utters the word in a garbled form but fails to recognize the correct form when it is presented to him. In other instances he does not recognize his own error spontaneously, but he is able to select the correct one of several forms suggested by the examiner. In either of these cases the concept of word-form may be said to be unsatisfactory. It must be noted, however, that this concept may be unsatisfactory when the patient still appreciates the significance of the word. Even gross misformations may have the symbolic value of the correct word-form.

---

[1] The correct oral spelling of a word which the patient cannot utter as a whole is a good illustration of exact knowledge of the word-structure, but it is by no means a typical performance. There are many patients who can produce a word or phrase satisfactorily as a whole but not its separate parts, whether component letters, syllables, or words. The whole is naturally the more automatic performance, comparable in this regard to the various "automatic word series" where the total sequence can often be produced when none of the separate items, except the first, can be brought out alone.

Defects in articulation and word-formation usually appear in every type of spoken response, but they may not be equally serious in all types. The fact that emotional, automatic, and reactive speech may be relatively superior to propositional expression, both in the extent of the product and in the quality of the word-structure, has already been noted; it is a condition of great theoretical importance. Differences in the severity of the disturbance are also apparent in repeating or in oral reading as opposed to spontaneous speaking. A number of patients, such as No. 4, whose record is given in Section 3, articulated much more accurately in repeating and also in reading aloud than in speaking spontaneously. Other patients like No. 6, whose case is summarized in Section 4, could repeat a phrase or sentence of greater length than any spontaneous utterance possible at the same time.

In the predominantly expressive disorders, there are usually only slight changes in the structure of the spoken or written expression. The changes in speaking, apart from hesitations for words and sometimes repeated attempts to produce them, consist of breaks in the continuous flow of language so that expression becomes more fragmentary, and of more or less marked simplification in the sentence structure. Often, too, there are specific errors which occur through the omission of words. These words are essential to the normal form of expression but are usually not those which carry the main import of the sentence. In rare cases when verbal omissions are much more frequent, the sentence structure is extremely abbreviated and the significance of the term "telegram style" becomes apparent.

In the predominantly expressive disorders as in the predominantly receptive, disturbances in writing usually parallel those in speaking. The extent of the disturbance, however, often differs in the two forms of expression. Following those of speaking, the most serious disturbances of writing in the expressive type of aphasia are defects in letter- or word-formation and simplifications and abbreviations in the structure of the sentence. Any of these defects may be more pronounced in writing than in speaking or vice versa. In rare cases like that reported at length in Section 5, defects in letter- and word-formation in writing were so severe as to create an almost distinct type within the predominantly expressive disorders.

Expressive disturbances of the nature described above may be far more pronounced than any other changes in the case, but they are not the only changes. The picture is always more or less complicated by disturbances in other language responses which are generally accepted as good indices of intelligent behavior. Even if there is no serious amnesic difficulty and the patient can name objects satisfactorily whenever he can form the name well enough, he is still limited in the production of words under more difficult controlling conditions. For example, he does not achieve the performance which would have been expected of him before the disorder on the Analogies Test; that is, given a series of problems like *"Rain* is to *summer* as *snow* is to ——," he cannot supply the fourth word so well as before even though he understands the single words and the nature of the problem. Furthermore, he almost always has difficulty on another type of language intelligence test, the Sentence Completion, where he must fill in the blank spaces in sentences such as: "Here is a man who —— do it." Even when he can read the sentences with ease, he may be unable to supply suitable words. Difficulties like these are clear when the aphasic patient's performances are compared with those of normal adults. If the disorder is severe, the patient's response may fall outside of the range of normal performances altogether; if it is slight his response may be within the normal range but still below that expected of a person of his educational and social status.

In the expressive disorder there are not only defects in expression and more complicated changes in language intelligence, such as those discussed above, but limitations in receptive functions. These are relatively less marked than the difficulties on the expressive side, but in some cases comprehension of both spoken and printed material is seriously limited.

There are also great variations in the quality of the responses on non-language tests. In comparison with the normal, most patients reach a relatively higher level in non-language than in language activities. A few apparently do as well in some non-language performances as they would have been expected to do before the disorder. Others, on the contrary, show serious disturbances which may not be comprehensible in terms of the language defects. In some of these cases analysis of the language and non-language disturbances indicates that both are manifestations of a basic disorder in mental functioning. Extensive changes of this nature have no direct relation to the severity of the language disorder. On the one hand, expression in speech and writing may be severely limited and receptive functions may also be affected when there seems to be no basic change in mental functioning. On the other hand, a change of far-reaching effect may appear when the specific language processes of expression and reception are relatively satisfactory.

2. A SIMPLE DISORDER: CASE NO. 33

Expressive disorders free of disturbances in receptive functions or in performances requiring intelligent behavior in language terms were not found among the hundred-odd cases investigated in the selection of the group of aphasic patients. There were, however, many cases where the limitations in receptive functions and in higher language performances were relatively slight, and where, aside perhaps from a rather general retardation, there was no evidence of any extensive disturbance in mental functioning. No. 33 was not the simplest case, but he is a satisfactory example of the group of relatively uncomplicated cases of expressive disorder.

No. 33.[2] *A case of relatively uncomplicated expressive disorder with marked disturbances in speaking. The lesion was largely cortical, resulting from a bullet wound in the central, parietal, and temporal convolutions.*

Male, Negro, 41; night watchman and bootlegger; one or two years of primary school; right handed.

Psychological Summary

The aphasia was predominantly expressive. Speech was limited and retarded, and characterized by effort and by defects in articulation. The defects involved particular speech sounds with greater constancy than is usually the case. They were not often such as to deform the word beyond recognition. The patient was almost always aware of his errors and could often by repeated efforts correct them. His speaking was further handicapped by a stutter which had been present to some degree all his life and had persisted and, in the patient's own opinion, become more severe after the injury.

No. 33 understood spoken language well, failing only on some of the more complicated language intelligence tests, such as the Absurd Statements, where the problem was not one of comprehension in the narrow sense but of the intelligent development of the significance of the whole statement. Performances in reading and writing were not interesting because of the patient's very poor education.

---

[2] The case summaries furnish sufficient material for the general reader. The more detailed reports which follow them have been included in their proper places in the text for the reader who wishes to know more about the performances in any particular case or the examination methods, or to form his own conclusions about the nature of the specific disturbances and their significance in the understanding of mental functioning as a whole.

He had no difficulty with naming tests but was limited in all the language intelligence tests demanding the production of words under given controlling conditions. His relatively poor performances on language intelligence tests seemed to indicate a pathological language disturbance rather than a simple low-grade performance because they were clearly surpassed by his performances on various non-language tests and they were inconsistent with his behavior in general. The non-language performances themselves were generally retarded, but varied in quality, a number being superior to the medians of the normal group.

The patient was first examined five years and three months after the injury, and the examination was continued for two and a half years. During this time the only noteworthy change was the greater facility and accuracy in articulation and the increase in the number of words he could pronounce. At the end of the two and a half years the findings were checked by a short new study made by an examiner who had not worked with the patient previously; the results obtained by different examiners were found to be substantially the same.

No. 33 was cooperative during the whole period of observation. It would probably have been possible to reeducate him had time been available. He took advantage of the work periods, occurring two or three times a month, to learn to pronounce words which were difficult for him, and then practiced these words by himself. He was extremely tenacious, never willingly giving up any work which he had once undertaken. On the whole he was cheerful, but he had periods of depression when he could see no progress or when other patients bothered him about his difficult speech or about his earlier occupation as a bootlegger. He reacted more quickly than the majority of patients in the city hospital wards to interesting or amusing situations. His comments on the other patients were fair and showed good insight. His relationships with them were usually comfortable and normal.

Neurological Summary

The patient was admitted to the Graduate Hospital in June, 1924, after an accident in which he received a "through and through" gun-shot wound of the head. He was intoxicated and unconscious on admission. There was a Y-shaped fracture at the junction of the parietal and temporal bones with the prongs of the Y pointing upward. An area of bone two inches long and half an inch wide had been ploughed away by the bullet and some brain substance had exuded into the wound area. There was a right hemiplegia which had apparently come on gradually in about an hour after the injury. Leg reflexes on the right side could not be elicited and no Babinski sign was present. Operative treatment consisted of débridement, removal of fragments of bone, and drainage. Post-operatively there was a right hemiplegia which was most marked in the face and arm; there was no spasticity and no Babinski. When the patient regained consciousness, it was noticed that he mumbled when he tried to talk, and had difficulty articulating.

The paralysis lessened gradually and in December, 1924, six months after the injury, the patient was transferred to the Philadelphia General Hospital. On admission, there was right hemiparesis which was much more marked in the face and arm than in the leg; and a sensory examination showed that while light touch was preserved, deep sensibility and vibratory sense were decreased, and pain and temperature sensations on the whole right side were also impaired. The patient had lues as shown by the Wassermann examinations.

He remained in the hospital for the following eight years and during this period his right hemiplegia persisted with a great deal of spasticity, increased reflexes, and Babinski. He was able to walk, however. Examination showed a persistence of his sensory disturbances, these consisting in diminution of touch, vibratory sense, muscle sense, astereognosis in the right hand, and, to a less extent, diminution of heat and cold. No visual symptoms were found.

The psychological studies were begun five years after the onset of his hemiplegia and continued over two years and seven months.

The lesion was traumatic and involved the left central, parietal, and temporal convolutions.

Psychological Report

SPEAKING. *Spontaneous speech* was extremely slow and very badly articulated. The sounds "k," "g," "q," "ch," "sh," "th," and "r" and the double consonants were particularly difficult. Furthermore, speech was continually disturbed by a pronounced stutter; the patient repeated initial consonants, prolonged them, and was sometimes held up for several seconds by a tonic spasm. He gave a history of slight stuttering before the injury, but said that the difficulty then troubled him only when he was angry or excited. The following speech record was typical:

> . . . . it worried me . . . an' Ah laid all nigh' long bouta lesson 'at you div me. Ah ussa 'ave a nice han-wy-in. Ah dess tussed . . . people ussa know me doan sss-speak eh me, dess e-nore me. Some p-people tsay: "Doan bodder wiv 'im; he tant talk; he's a dommy." . . . . Ah ain no dommy ah a 'ong sight, but Ah tant so it ss-somehow.

He himself was aware of his particular speech difficulties and made a great effort to overcome them. Sometimes he was able to correct his faulty articulation by careful repetition. Very often he consciously substituted synonyms easier for him to say than the more customary word. Finding it hard, for example, to say either "watch" or "clock," he substituted "time-piece."

He made no errors in the use of words in speaking and no grammatical errors other than those characteristic of his social and educational level.

During the course of two and a half years the patient's articulation improved somewhat. His speech became more adequate as well because he practiced "hard words" and gradually added to the number he could pronounce. His maximum speed, however, never increased beyond thirty words a minute. His stutter persisted.

His chief difficulty with *automatic word series* was in articulating the words. He could count and say the days of the week, but he could not pronounce the names of the months. At first he could not say the alphabet, but at the second interview, probably after some practice, he wrote it correctly.

No. 33 pronounced words in singing with somewhat less difficulty than in speaking. He remembered the words and the melody of many familiar songs and could reproduce these well.

Naming. He named common objects and pictures of objects correctly except for his errors in articulation. He named all the colors of Head's Test correctly except "red," and this he regularly called "purple" or "lavender."

Repeating. The patient repeated short sections with a natural inflection, and with slightly better articulation than that of his spontaneous speech.

Understanding spoken language. No. 33 understood ordinary conversation very well. He could always carry out a series of three commissions (Stanford Binet, Year VI; Marie's Paper Test). He could select the correct one of four pictures to illustrate sentences read aloud to him (Gates Word, Phrase, and Sentence Reading, given orally); and he did fairly well with longer directions (Gates Reading of Directions Test, given orally). He could set a clock to oral command with only an occasional error.

He was also able to follow directions requiring good spatial orientation, passing the Kuhlmann Comprehension Test, Year VIII, and succeeding promptly with all the oral commands of Head's Hand, Ear, and Eye Test.[3]

Reading. No. 33 asserted that he had never been able to read more than a few words. His performances in writing the alphabet, in writing his name, and in cancelling a's in pied text showed that he did know his letters. Apparently thinking it better to fail altogether than to make errors, he attempted reading tests with the greatest reluctance, and was not successful in selecting the correct picture to illustrate a word or sentence or vice versa.

Once, however, in the course of an experiment with the Healy Bronner Learning Tests, he showed very clearly that he was not repeating the story about the picture by memory, but that he had fallen into the trap laid for him and was picking out key words from the printed text left on the table beside him. On the whole, therefore, it seemed probable that the patient had retained about as much facility in reading as he had ever acquired.

Writing. Using his left hand, No. 33 printed his first name and the alphabetical series correctly. Other than this he would not write spontaneously nor to dictation. His refusal was undoubtedly based on true inability; he made mistakes in spelling very simple words aloud. He copied from print into print with great care and no errors in single words.

Arithmetic. When No. 33 attempted simple *arithmetic computations,* he complained that he was unable to pronounce the answers. He made as many errors, however, in holding up the correct number of fingers to indicate the answer as in pronouncing it; he very rarely answered correctly in either case. He had a little more success with *arithmetic problems* when these were read to him, but even here fell in the poorest quarter of the normal group.

Performances on language intelligence tests. The results of the language intelligence tests were interesting in this case because the patient understood spoken language in the ordinary sense and was able to express his own ideas. Nevertheless, in all tests requiring the *production of words under various controlling conditions*—the Opposites, the Analogies, the Sentence Completion, the Jaederholm Classification Test, the Rhymes of the Stanford Revision, Year IX—he fell near the poorest of the normal group. In each case he grasped the problem easily but was unable to produce a sufficient number of correct responses, even in more than the normal time.

On the *Absurdities Test* he ranked slightly higher in comparison with the normal, but he often repeated the substance of the statement correctly without grasping the absurdity. These failures were the best evidences of the limits of his comprehension of spoken language; they showed that, while he understood conversation and even fairly complex directions and questions, he often did not grasp the whole significance of verbal relationships.

---

[3] In imitating the movements made by the examiner standing face to face with him and in following the pictorial commands of the Hand, Ear, and Eye Test, the patient almost always reversed the procedure when the movements were crossed, carrying the right hand to the left ear instead of the left hand to the right ear and vice versa. When the hand was moved to the ear or eye of the same side, he very frequently used the opposite hand and ear or eye.

On the *Stanford Binet Vocabulary Test* he was again slightly above the lower limit of the normal group. Provided they indicated some recognition of the word, his responses here were accepted even when extremely fragmentary. His failures then actually depended on his inability to recognize the word and thus indicated a limited vocabulary.

On the whole, the language intelligence tests showed a difficulty in producing suitable words, a language poverty, and a failure to grasp complicated language formulations which ranked the patient with the low-grade and illiterate normals whom he clearly did not resemble in the quality of his responses on some of the non-language tests or in practical or social behavior. It seemed obvious, therefore, that, as in so many other cases, the language inadequacies were direct manifestations of the aphasic disorder.

REPRODUCTION OF VERBAL MATERIAL. Throughout the two and a half years of observation, No. 33 could repeat only four digits, four separate words, and sentences of about ten syllables. Whenever the sequences were longer, he not only made errors in articulation, but confused the numbers, letters, or words. In reproducing the short story of eighty-two words after hearing it three times, he was not able to give the normal number of points, and his expression was very poor (Auditory Verbal Memory Test). That his performances did not improve toward the end of the observation when he pronounced words more accurately and easily, indicated that the shortness of his immediate reproductions was a distinct defect which did not arise from difficulty in pronunciation.

Informal observations showed that the patient often remembered tests he had had some time before, and was able to reproduce the substance of several conversations which had taken place a year or more before.

NON-LANGUAGE PERFORMANCES. Since the patient could use his preferred right hand only as a support for the object he was manipulating with the left, he suffered a severe handicap which had to be taken into account in evaluating his performances. His time scores for the *formboards* of the Shorter Pintner Performance Scale fell near those of the poorest of the normal group; much of his slowness undoubtedly depended on the enforced use of his left hand. The quality of his performances as measured by the number of moves required to complete the board or the number of errors made, was superior to the median of the normal group. He recognized the suitable forms quickly, planned for their placement so that he made very few random moves, and in general gave evidence of a high-grade type of performance.

His score on the *Picture Completion Test* was also slightly above the median of the normal group, showing that he was relatively well oriented with pictures as with geometrical forms. His score on the *Drawing Completion Test* of the Pintner Non-Language Scale was considerably below the median of the normal group, but rather because of his difficulty in drawing the missing parts than of his failure to recognize them.

The formboards and the picture completions were his best performances. He did poorly when he tried to imitate patterns traced by the examiner (Knox Cube Test and Imitation Test). His responses in reproducing figures immediately after presentation fell among the poorest of the normal group. He copied the numbers in the Digit-Symbol Substitution Tests very slowly, and could solve few of the problems of the Reversed Drawing Test or of the Picture Reconstruction.

His own *drawing of a man* was fairly complete but very crude; scored on the Goodenough Scale, it fell near the lowest quartile of the normal scores.

He worked very hard to assemble the mechanical devices of the *Stenquist Mechanical Aptitudes Test;* but his score was only that of the 87 percentile of army men. He could not overcome the handicap of the enforced use of the less skilled hand, and the consequent difficulty in trying out tentative solutions for the more complicated devices.

No. 33 was below the median of the normal group in tracing the *Porteus Mazes.* He proceeded with less deliberation than most of the normal persons or the other aphasic patients, and his failures probably depended on lack of foresight as well as on unsatisfactory visual analysis of the maze situation.

3. A MORE COMPLEX DISORDER: CASE NO. 4

No. 4 represents a more complex disorder than No. 33; the characteristic defects in the articulation and formation of words were complicated by occasional confusions in the use of words and grammatical structures, and a variety of language and non-language performances were so changed as to indicate a rather extensive disorder of mental functioning.

No. 4. *A more complex expressive disorder with particularly severe disturbances in all performances requiring constructive mental activity. The patient was of great interest because he had seven languages at his command. The lesion was probably subcortical, resulting from thrombosis of the left middle cerebral artery.*

Male, white, 49; professor of Romance Languages; degree of Ph.D.; right handed for all unimanual activities but takes left-handed position for all bimanual.

Psychological Summary

The aphasia was predominantly expressive, with rather complicated disturbances in speaking and writing, and with pronounced changes in those language and non-language activities which required most constructive, synthetic mental activity. At first there were serious difficulties in expressive processes: articulation and word-formation were defective, speaking and writing were unusually simplified, and were disturbed by verbal omissions and by confusions in words and grammatical structures. The normal inflection of speech was destroyed. At the same time receptive functions were fairly satisfactory; limitations appeared chiefly in those performances requiring the intelligent development of the significance of the language formulation as a whole.

Performances on language intelligence tests were all below those which would have been expected before the attack, but those which involved the most constructive, creative mental activity were the most seriously affected. The patient's responses on Sentence Completion Tests, for example, were especially poor. Performances on non-language tests dependent upon constructive mental activity were also affected, and the disturbance was not always comprehensible in terms of the language difficulties. Some non-language performances which were largely of a reproductive character remained at relatively high levels when language was very inadequate. Thus while most performances, language and non-language, were affected to some extent, the most serious disturbances appeared when the patient had to produce language formulations to express his thought or to effect a synthesis to construct a coherent whole.

No. 4 was particularly interesting because he had probably been the most intelligent patient of the group and the best educated; certainly he was far superior to any of the others in his linguistic attainments. He spoke several languages fluently and had a superior knowledge of several others. These languages were found to be disturbed much as English was disturbed. Furthermore, he had the reputation of being a rapid lecturer, and as a result of his many years' training he was undoubtedly far superior to the members of the normal group in speed and facility of expression.

As the patient improved, his articulation became increasingly easier and more accurate and his inflection more normal; his hesitations for words were less marked, and his sentence structure was more complex and showed very few errors. Together with his improvement in the construction of verbal formulations, there was also marked improvement on language and non-language tests which demanded constructive mental activity.

As indicated by frequent observations and periodic tests, the improvement was gradual, with negative acceleration. Figure 1 (page 162) shows his successive performance levels three, five, and nine months after the attack, in terms of the deviations of his scores from the normal medians. The lines are broken because not every test was given at each examination

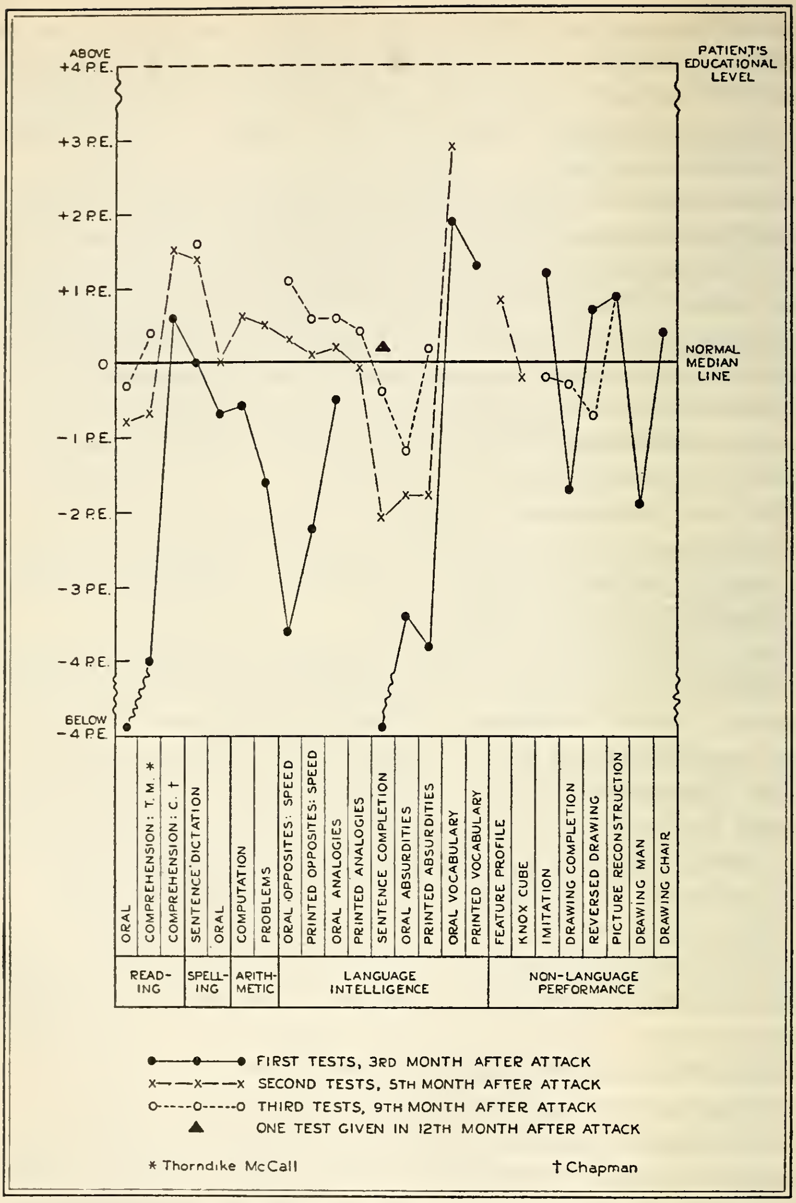


Figure 1. Successive performance levels: Case No. 4, expressive

period, but it is evident that improvement occurred in almost every performance tested. Moreover, most progress was made in the performances at first most seriously disturbed so that within the ten months of study the specific characteristics of the disorder had largely disappeared. The amount of improvement was often great; in many performances the patient progressed from a level below the lower quartile of the normal group to a level near the upper quartile. Even then, of course, he had not reached his former rank. The effect of the training, given about three times a week through many types of practice, could not be estimated, for improvement would undoubtedly have taken place without training. It is, however, noteworthy that a really extensive amount of progress was made, and was still continuing, though at a slower pace, twelve months after the attack. In another two months the patient felt able to return to his work, and taught successfully about half his usual number of hours.

No. 4 cooperated extremely well. He carried out directions to the best of his ability, did all the practice work assigned to him, and devised some of his own. The gradual improvement which he saw in his work made him generally cheerful and confident. A delightful sense of humor enabled him to accept his mistakes with some equanimity. While he had a good deal of insight into his disorder, he probably never recognized its severity. His interests in his friends and in public affairs were apparently unchanged. He understood the members of his family extremely well and continued to adapt to them with little difficulty. He was naturally concerned about his future, and his sense of responsibility for his family was the chief factor in his occasional periods of depression.

Neurological Summary

The patient had had hypertension for some years, and reported that at one time, while at an elevation of 5,000 feet, he had a temporary weakness of his right leg and stumbled when fatigued. Thirteen years later and about eight weeks before being observed, while attempting to get out of a train berth to talk to a porter, he found he was unable to utter a sound. His wife at that time noticed drooping of the face and loss of control of his voice. Within half an hour he was unable to use his right arm and a few hours later his right leg was weak and he dragged it when he walked. In two or three weeks his speech gradually returned. After a few days the leg improved gradually but the arm was slower in return of power.

Examination a month later showed distinct drooping of the lower right face, lagging of the right palate, and deviation of the tongue to the right. The right arm and leg were contractured in a hemiplegic position. All the right tendon reflexes were increased. There was clonus in knee and ankle and marked Babinski. Sensation was normal. The patient was under constant observation and was given massage and corrective exercises, and his hemiplegia lessened to some extent. About six months after the onset, it was noticed that he was not progressing so well as he had been. This was accounted for by a rise in his blood pressure. Regulation of his diet and elimination corrected this, with a corresponding improvement in his psychological performances.

The lesion was undoubtedly a thrombosis of the left middle cerebral artery.

Psychological Report

Speaking. According to his wife's report, the patient had been unable to speak immediately after the attack. His speech had then improved gradually over a period of six weeks, but it was less satisfactory during the seventh week when he was excited by arriving home. When he was first examined during the next week, *spontaneous speech* was characterized by considerable effort and disturbance in articulation and in the formation of words. There was frequent stuttering on the initial sound of a word. The speech as a whole was hesitant, scanty, and fragmentary, with the meaning often indicated by words and phrases rather than expressed naturally in complete sentence form. The following conversation represented the most adequate speech in the beginning of the study:

> (Do you sometimes think of words more easily in some other language besides English?) Yes . . . yes . . . . constantly . . . the . . . . I feel . . . the "family" . . . . er, "members of the family" . . . . I get in Spanish . . . . and French rather . . . . rather . . . . er rather than in English . . . . an' English is not coming . . . . (Does the German come easily?) No! . . . . (Or Italian?) No . . . . Except in "ausgegangen" . . . and so forth . . . . I *study* my German *for* eight and nine and ten and eleven . . . . and so forth . . . . an' humorously . . . . "ausgegangen" . . . . an' my German . . . . I . . . . er *learn* it at sschool for six years . . . an' Junior and Senior in college . . . I took it up again.

Defects in articulation and in the formation of words were sometimes more prominent than in the above report, which was, however, an excellent example of his serious difficulties in the evocation of the necessary words to express his thought and the formulation of that thought with sufficient completeness.

Verbal errors, with the exception of the confusion of "yes" and "no," were rare. There was only one in the section quoted, the use of the preposition "for" when "at" expressed the meaning. True grammatical confusions, as distinct from the defects consequent upon the omission of much of the sentence, appeared only occasionally. There were two in the section above: the use of the verbs "study" and "learn" in the present tense when the past tense would have been the acceptable English form. Representing as they did the omission of the necessary verbal endings, these two errors were also to be related to the incomplete and abbreviated form of expression.

No. 4 could say *automatic word series,* numbers, the days of the week and months of the year, and the alphabet, with fair certainty and rapidity. He articulated the words of these series better than those of propositional forms of speech.

Although fragments of verse frequently came to his mind, he could not recite long sections of poetry. He thought that he formed words more clearly in singing songs or hymns, but the differences were comparatively slight. He could reproduce the melodies of familiar hymns correctly.

Naming. At first No. 4 made several errors in naming the objects of Head's Test, substituting "knife" once for "key" and once for "pencil," and "matches" once for "knife." He could always describe the use of the object. He picked out the objects to oral command and to written command with only one error in each series. He made one error in naming the objects placed in his left hand out of sight. In naming the Kuhlmann pictures, which represented a wider variety of objects, he made no errors but several times substituted French equivalents for the English names.

He named the colors of Head's Test correctly and selected them accurately to oral or written command. He hesitated for the name several times and once gave the Spanish term immediately after the English.

Repeating. With very few errors, No. 4 could repeat words containing each speech sound. He immediately perceived any differences between the examiner's pronunciation and his own, and he almost always was able to correct. During the first weeks the tone of his voice was unnatural and monotonous in repeating these words and in repeating longer sections. With the longer sections, furthermore, he articulated less well and separated the words unnaturally.

Understanding spoken language. The patient understood ordinary conversation and generally carried through two- or threefold directions with ease. His only difficulty in following directions appeared on the Abelson Geometrical Figures Test when he had to point to some particular spot in a series of interlocking geometrical figures, to point, for instance, to a spot "inside the square and the circle but not in the triangle." His performance was far below the median of the normal group. In response to the more difficult items of the series he began to follow the directions in a piecemeal fashion, pointing, for instance, inside each of the two circles separately and then inside the square instead of finding one spot within all of these figures. Repeated explanations did not change his procedure, which, as a matter of fact, reappeared on a second test two months later when there had been a great improvement in all the expressive forms of language. He could sometimes repeat the directions correctly when he could not point to the particular area within the given figures. Apparently he could not effect a synthesis of the parts of the direction. This difficulty, like that he experienced in detecting the incongruities of the Absurd Statements, was thus not a simple disturbance in the understanding of spoken language, but a limitation of the further development of the understanding normally characterizing the intelligent mind.

Reading. No. 4 pronounced 93 of 100 words of graded difficulty correctly, thus demonstrating a much more satisfactory pronunciation in *oral reading* than in spontaneous speaking (Gates Pronunciation Test). At the same time he was uncertain, hesitant, and inaccurate in naming single letters, and in articulating the sound represented by a letter or by a meaningless combination of two, three, or four letters. Sometimes he was able to correct his error spontaneously. In pronouncing the sound combinations he had difficulty making rapid adjustments for the succeeding items; he carried over a sound from one item to the next and even, once or twice, gave the next sound in alphabetical order instead of the correct sound. He also made distinct errors, giving "n" as "err," "ch" as "sh," "br" as "pr," "ot" as "ob," "ap" as "ab," "plin" as "pling," and "pran" as "pram." These results, perhaps not remarkable for the low-grade adult, were significant in the case of No. 4. They did not indicate simply the unusual difficulty with nonsense material which has sometimes been said to be characteristic of patients with brain injuries; for No. 4 was relatively successful with nonsense material when the opposite process was involved, that is, when he had to give the component letters of nonsense syllables. As in other types of performance the synthetic process was thus more severely disturbed than the analytic. The patient had difficulty in producing the correct sound, although he often recognized an error once made, and he had difficulty creating the sound combination as a whole.

He read paragraph material extremely slowly and with little change in pitch; he made almost as many errors in reading as the poorest of the literate normals (Gray Oral Reading Paragraphs). These errors, like his errors in speaking, were chiefly mispronunciations.

No. 4 was extremely slow in silent as in oral reading, but his *comprehension of printed material* was at a higher level than his rate of reading or his accuracy in reading aloud. During the second week of study he fell among the lowest quarter of the normals when he had to read a paragraph and indicate his comprehension by answering questions on it (Thorndike McCall Reading Scale). Two weeks later he was almost at the upper quartile of the normal group on a comprehension test where he had only to pick out the one word in each paragraph which did not fit the meaning of the whole (Chapman Unspeeded Reading-Comprehension Test). The difference between his levels depended partly on his improvement during this two-week period, but largely on the fact that the one test demanded a verbal formulation of his answer while the other required only the selection of a word. His comprehension of verbal relationships was superior here as elsewhere to his own verbal formulations; nevertheless both reading comprehension tests showed that he did not understand the material so well as he would normally have understood. He could not, for instance, select the inappropriate word in the following paragraph:

> At about ten o'clock at night, John's mother noticed that he was nodding. "Wake up, son," she said, "It is time to go to school for it is getting late."

The word "school" was finally pointed out to the patient, but he did not believe it to be the necessary solution because the mother had said "wake up" when "it was time to go to bed." This unusual and limited understanding demonstrated in his reaction to printed material, as to spoken, that the receptive functions in the narrow sense were intact; the difficulty appeared rather in the further creative activity normally arising with adequate reception and resulting in the development of the verbal formulations into their higher and more complex relationships. It was, in other words, essentially an intellectual disturbance.

Writing. In writing spontaneously the patient used very simple constructions, some few of which were erroneous; he experienced some difficulty in the choice of words and occasionally misspelled words, usually through omitting one or more letters. He was well aware of his difficulty in expressing his thought naturally, complained that the ordinary phrases were gone and that he had to substitute "school-girl English." The difficulty was apparent in the following letter, his first written production of any length, in which he also made three distinct errors, two in spelling and one in the phrase "the next Saturday" which is the French rather than the English form of expression:

> Dear Anne:
>
> I like the flowers very much and I feel per*fcet*ly wild about them. Send some up to-morrow. I feel *a* right to-day, but I am anxious to go out *the* next Saturday.

The construction of sentences around one, or later two or three given words, was used as a practice exercise and as a means of studying the development of sentence structure (see Table VII, page 180). At first the patient used the given word in a phrase or a very simple sentence, and even then made errors occasionally. The following errors appeared in the first attempt:

(apple)	I like good app*le*
(book)	*The language got books*
(eye)	My ey*es* hurts
(ground)	*I have placed in the ground*
(hour)	An hour and a *hafe*
(month)	I *am here* next month

The patient could recognize and correct the simple errors here—the incorrect single "apple," the incorrect plural "eyes," and the misspelled "hafe"—but he saw nothing wrong with the other three statements. The last one was another construction carried over from the French, a type of error which he made rather frequently. Within the following month the phrase responses disappeared altogether from these exercises and the sentence structure became more complex. Occasional errors persisted for a while, notably incorrect addition or omission of "s" in both nouns and verbs with the consequent confusion of singular and plural.

An interesting test, the Briggs Analogies Test, gave further evidence of his difficulty with grammatical forms. When he read the three words and had to produce a fourth having the same relation to the third which the second bore to the first, he made frequent errors in the form of verbs and some in pronouns and in the possessive. The following examples were typical:

give—given . . . . . . sing—*singing*
log—logs . . . . . . himself—*himselves*

Sometimes he could correct these errors when questioned about them. The superiority of his appreciation of correct verbal usages and grammatical forms over his ability to use these was apparent from the results of the Stanford Achievement Language Usage Test. Here he almost invariably selected the correct one of two words or forms and—an even more significant point—he laughingly chose the colloquial word in several cases where the technically correct form seemed stilted.

No. 4 surpassed the median of the normal group on every test of *writing to dictation*. When single words were dictated he almost reached the upper quartile of the normal group. Apparently because of the confusion in grasping the whole sentence at once and keeping some words in mind while others were written, he did slightly less well with the sentence dictation. The patient considered that from his school days on he had always been a good speller. Since his spelling had remained superior, not only to the median levels of the normal group but to his other performances, he had obviously retained much of what he had learned about the spelling of words. His success at first seemed to depend largely on more or less automatic performances. He spelled correctly and quickly some of the difficult words failed by more than two-thirds of the normals, words such as "eminent," "undoubtedly," "acquaintance."

At the same time he made unusual errors in relatively familiar words. A Confusing Dictation Test, constructed of words sounding alike but requiring different spelling, showed that he had lost much of that adjustment of the spelling according to the sense of the word which has become more or less automatic even for persons less well educated than he.

An analysis of his errors on all the dictation tests showed that they differed from the normal in a slightly larger percentage of omissions and of gross errors. The latter occurred sometimes because the patient confused the English word dictated with a similar word from one of the Romance Languages. Other times when he repeated the word correctly, he nevertheless made a serious mistake in writing without being aware that he had done so. When "correspondent," for example, was dictated, he gave the following response:

Speech	Written product
correspondent	*correst*
correspond	Adds *e*
correspondent	Adds *dant,* so that the final product was *correstedant*

Even when in pronouncing the word he clearly divided it into syllables, he sometimes omitted a syllable or spelled it in an absurd fashion. When the more or less automatic response was disturbed, he could not make a phonetic analysis of the word and represent the sounds involved by the correct letters. In so far as the difficulty was one of analysis, it affected a type of performance in which he was relatively successful. He had been better able to give the component letters of nonsense syllables than to pronounce similar syllables. At the second series of dictation tests two months later, he was more successful in analyzing the words about which he was uncertain, but still experienced difficulties similar to that described for the word "correspondent."

His difficulties were greater in *oral spelling* than in written, and he was not quite up to the normal median on his first oral spelling test. Again his spelling of words well within his ability was sometimes far from that which would be phonetically justifiable. Occasionally when he wrote the word he had failed, the more objective written product enabled him to appreciate and correct his errors.

On the whole then, while the dictation tests showed that spelling was a performance in which the patient was clearly superior, they also showed many abnormalities in his responses; there was evidently a good deal of confusion even though the performance depended so much on analytical work.

No. 4 *copied from print* into script very slowly but with rare errors. He was of course just learning to use the left hand in writing. After two months' practice in writing he copied at an average rate of ten words a minute, that is, about one third of the normal rate.

ARITHMETIC. No. 4 fell near the lower quartile of the normal group on *arithmetic computations;* his score was poor because he failed to solve the longer computations correctly (Stanford Achievement Computation Test). He recognized all the arithmetical signs without difficulty.

He was slightly below the lower quartile on the *arithmetic problems,* where his failures usually depended on an incomplete understanding of the conditions of the problem (Stanford Achievement Reasoning Test). Given the problem:

> A boy saved 5 cents a day for two weeks, and 10 cents a day for the next four weeks. How much money does he then have?

the patient responded as follows:

> Five cents a day for two weeks . . . (Wrote down 10.) . . . and ten cents

a day for the next four weeks . . . forty . . . . fifty. (Wrote down 50 as the answer.)

He undoubtedly understood the terms "day" and "week," but failed, as he so often did, to appreciate the further significance of the terms in the given relationship, the conditions established by the phrases "so many cents a day for so many weeks."

Performances on language intelligence tests. The results of the language intelligence tests were particularly interesting because the patient's language abilities had formerly been so high. He did relatively well with the simple words of the *Opposites Tests,* giving as many correct responses as the median of the normal group but requiring far more than the median time. In response to the *Analogies Tests,* where words and relations of greater variety and difficulty were involved, he did not at first give so many correct answers as the median of the normal group, and he was again very much slower than the normal. On the whole, however, his performance with these controlled association tests, like his performances in naming objects, showed that he could produce appropriate words under definite controlling principles if he were given time.

On a number of supplementary tests where the selection of words required a more creative performance, less directly dependent on the stimulus words than were the responses to the Opposites and Analogies Tests, there were evident more serious limitations, which were striking in so intelligent and well-educated an individual. The patient could not name enough objects within a given class to pass the Jaederholm Classification Test at the VIII-year level. Given the letters A, E, I, R, L, P he could construct only five words from them in five minutes, a performance of about the X-year level (Whipple Word-Building Test). His difficulty was not one of spelling; he could have spelled most of the simple words which can be built from these letters had they been dictated to him. Apparently he could neither produce a number of words and check them to find whether they could be constructed from the given letters, nor could he by different arrangements of letters construct word-forms from which he could select any true words. The test required either or both the performances most difficult for him, the evocation of words when no simple controlling principle existed and the creation of a synthesis from a number of given parts.

The responses on the *Sentence Completion Test,* which at first ranked No. 4 well down in the poorest quarter of the normal group, were produced with great difficulty. Generally the patient suggested several words for each blank space, just as he later tried several pictures for each space on the Picture Completion Test. If he produced the correct word at all, he selected it for use in the sentence, but as soon as the sentences became longer or more complex he failed altogether. The Sentence Completion was probably a more difficult test for the patient than the controlled association tests just because it required not simply the education of correlates or relations from given stimulus words, but the creation of a coherent whole on the basis of an incomplete series of parts.

The patient's somewhat defective understanding of spoken language or printed material was a handicap on the *Absurdities Test.* Whether he read the statements or heard them read to him, he failed to understand as many as the median of the normal group. Being so far above average in intelligence, he would normally have grasped all the incongruities rapidly. Instead he asserted that some of them were "all right," and commented on others in a way which showed that he had not altogether understood them. These comments were fragmentary and ambiguous on the first examination, but on a second examination several months later they were extensive enough to show that the failure did not depend on faulty expression. The following examples were most illuminating:

1. *The absurd statement:* An old gentleman complained that he could no longer walk around the park as he used to; he could now go only half way round and back again.
The response: Correct, I think . . . half way round and back. I would er . . do that now.
2. *The absurd statement:* Soap smells nice but it tastes horrid. It tastes worst of all when you get it in your eye.
The response: The . . er soap . . . er . . usually doesn't . . doesn't . . mm . . er . . get in the eye, but I don't know whether it might.

In the Absurdities Test as in some of the more difficult comprehension tests, he appreciated the meaning of the verbal formulations in a narrow sense, but sometimes failed to develop from this meaning the further significance of the statement. He was lacking in those higher integrative processes characteristic of intelligent thinking, and certainly characteristic of his own thinking before the attack.

In every sort of performance, constructive and creative functions were more seriously disturbed than receptive and critical. In the higher language performances the contrast was clear: the patient was below normal when he had to evoke words in situations demanding constructive mental activity. At the same time he appreciated the particular significance of words (not the ultimate meaning of complex verbal formulations) better than the median of the normal group. Even in the beginning of the study, he was able to indicate his recognition of enough of the words of the *Stanford Binet Vocabulary Test* to reach the upper quartile of the normal group; his expression at this time was of course halting and incomplete. Consequently, he was even more successful when he had only to select that one of five words synonymous with a given word, and in the first week of observation his score fell among the highest of the normal group on a vocabulary test of this type, the *Thorndike Word Knowledge.*

Reproduction of verbal material. No. 4 was able to reproduce five digits, four letters, and four words after oral presentation, and six digits and four letters after visual; he was thus somewhat below the median of the normal group.

He was slightly handicapped by his difficulty in articulating the words. This difficulty in articulation at first made it impossible for him to repeat sentences of more than about twelve syllables. In a month or so when his speech had improved he was able to repeat about sixteen syllables, but he became confused with longer sentences and omitted or substituted words or phrases.

Non-language performances. Many of the patient's non-language performances were below average, and specific instances of poor performance unusual for a man of his intelligence were more striking than instances of superior performance.

He was relatively successful with the *formboards* of the Shorter Pintner Performance Scale, approaching the normal medians more nearly in the quality of his performances than in speed; his slow work was dependent to some extent on the enforced use of his unskilled left hand. He searched for blocks of the size and shape necessary for the sections he was working on and showed very little trial-and-error behavior.

Because of his handicap in writing, his slowness on the *Digit-Symbol Substitution Tests* was insignificant, but on the *Gates Visual Perception Tests* his manual handicap was not an important factor; he had only to mark those of the pairs of figures, of digit sequences, or of words wherein the two items of the pair differed, or to mark that one of five figures corresponding to a given figure. His scores, which were considerably below the normal medians on the first examination and again below two months later, showed how great his retardation might be even in relatively simple perceptive processes. The retardation was actually greater each time on the figure tests, tests which did not depend directly on language formulations.

The patient's responses to the *Imitation Test* of the Pintner Non-Language Scale, showed a different condition, a "non-language" performance which remained high when language formulations were severely affected, and later seemed to suffer directly as verbal solutions were introduced. In reproducing the patterns traced by the examiner on a row of four dots, No. 4 first surpassed the upper quartile of the normal group. When questioned as to his method, he said "memory." Questioned further, he explained:

> I . . . er . . . that one . . . and that square . . . and one and that square . . . and the clean sweep . . there and the clean sweep.

The "clean sweep" each time indicated a jump, but he gave no verbal expression of the direction of the jump. On a later attempt at the same test, when he did less well and fell slightly below the median of the normal group, his speaking had improved so that he could explain his method in more detail; he said:

> The . . er . . last three or four I remembered . . that . . er . . four points an . . er . . two one an one two . . . . (And before that?) They're easier and I just remembered the . . . er . . curves . . . the er . . . . (How they looked?) Yes! You could visualize the drawing; but you say one

> . . two . . one . . three . . one . . . . well, er two or three months ago, I would have been hopelessly confused. (With which?) The . . . er . . oral speaking.

Evaluation of introspective reports was always difficult when expression was so faulty, but in this case the patient's two reports together with the two different performances made it fairly clear that throughout the first test and the first part of the second his method was largely a visual one; he remembered "that square and that square and the clean sweep"; he remembered the "curves." On the second test for the last three or four patterns, the most complex, he tried a counting system and failed each item. Yet he had reproduced these same complex patterns on the first test when his introspective report seemed to indicate a visual system and when his expression was certainly too faulty to permit of successful reproductions based on verbal formulations. In other words, he had shown a high-grade performance when he depended largely on reproduction in visual terms and a second comparatively poor performance which was inferior to the first exactly where the old method was discarded for a new one based on verbal formulations. The results were important on the one hand as a part of the extensive data from a number of cases which showed the high quality of non-language performance which could be maintained when language was inadequate, and on the other hand, as evidence of the disturbance which faulty language formulations sometimes brought about in the so-called non-language performances.

In *reproducing figures* immediately after a ten-second exposure, No. 4 at first drew the essential lines very much more slowly than the normal and made many more errors (Kuhlmann Test of Immediate Recall). Toward the end of the period of observation he reached the median of the normal group in speed of drawing but still made a greater number of errors.

The *Picture and Drawing Completion Tests* were interesting in this case because the patient, while he often reached the median of the normal group in score, nevertheless made unusual errors and fell below the expected levels for a man of his intelligence. On the Picture Completion Test of the Pintner Performance Scale, he often could not go directly from his study of the board to the necessary piece to complete the picture. He required the unusually long time of nine minutes to complete the test. Although with the formboard material he had usually been able to make his selections immediately he often tried several pictures before he secured the correct one or placed one picture in several places before he was certain about it. In comparison with his work on the formboards, in other words, he required an actual construction of the picture situation, instead of mental reconstruction, before he could judge its accuracy. In view of his difficulty with picture completions it is no wonder he detested the jigsaw puzzles his friends sent in for his diversion.

On the Drawing Completion Test of the Pintner Non-Language Scale, when he could not select one of a number of given pieces to complete the picture, but had instead to draw whatever was missing, his score was slightly below the normal median. His most serious error occurred when he added a second trunk in the picture of the elephant, placing it under the trunk already represented, and, on questioning, naming it "a trunk." Not only did he miss the fact that the elephant lacked an ear, but he created an absurd picture, without being immediately aware of his error, by adding the second trunk. Another Drawing Completion Test, taken from the Detroit Primary Intelligence Test, showed other unusual errors. He could not decide how to complete the drawing of the house which showed the chimney terminating *beneath* the roof. Urged to make some response, he said:

> Oh . . I don't know . . . the gravel but . . . I . . . (Is there anything missing there?) . . Pretty . . idiotic thing but I don't know . . . can't be certain.

He then drew two lines to represent a "gravel" path up to the front step. He considered the picture of the hand with the third finger missing for 40 seconds and then drew a finger between the index finger and the thumb (Figure 3, opposite). The length of time he required even when he made a correct response was definitely abnormal. The missing parts throughout were obvious and would have been recognized almost instantaneously by the normal adult; No. 4 required an average of 20 seconds per picture.

In view of his uncertain and sometimes absurd completions, he was given a part of the Indiana Mental Survey, a section made up of thirty pictures of objects with something absurd in each picture. In pointing out the absurdity the patient made only three errors, but these were serious. He could not, for example, tell what was wrong with the picture of the telephone with *two* receivers. On the whole, however, his recognition of absurdities was relatively superior to his performance in drawing the missing parts. If an interval of several days had elapsed, he could usually recognize the errors in drawings he had himself completed badly. It was clear that he was uncertain about the pictures in the first place and about his selections, but relatively well able to judge the fitness of solutions once made, particularly if he approached them as new problems at a time when his earlier confusion had disappeared. Thus in this nonlanguage situation, as in many language situations, his constructive work fell below the level of his comprehension and his criticism.

In *free-hand drawing,* which he attempted only with the greatest reluctance, his productions showed that he experienced most difficulty when he had to construct the drawing himself instead of copying it or reconstructing it from a model. His drawing of a chair from a model was a capable performance, slightly superior to that of the median of the normal group (Figure 4, page 175). The drawing was rough but the perspective was fair and the only actual errors were the omission of one rear leg of the chair and confusions in the direction and location of the stretchers.

He found the drawing of a man a very much more difficult problem. He was

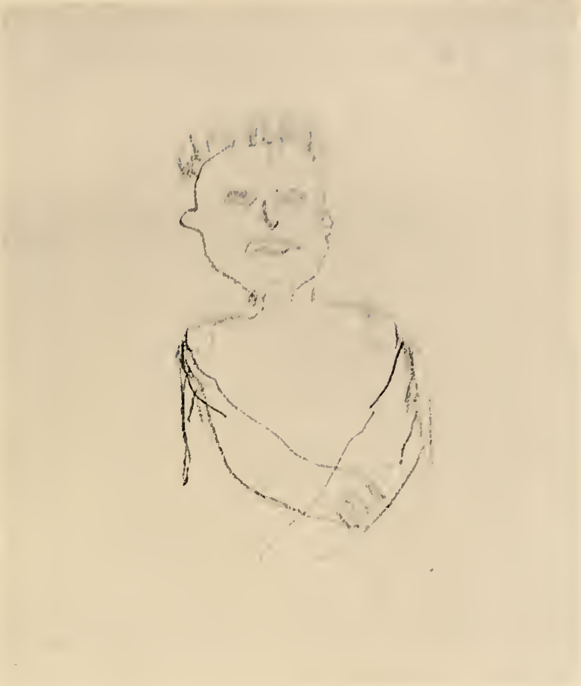


Figure 2. Drawing of a man: Case No. 4

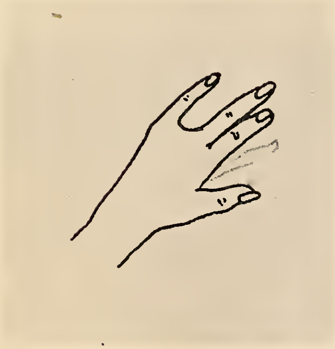


Figure 3. Completion of the drawing of a hand:
Case No. 4

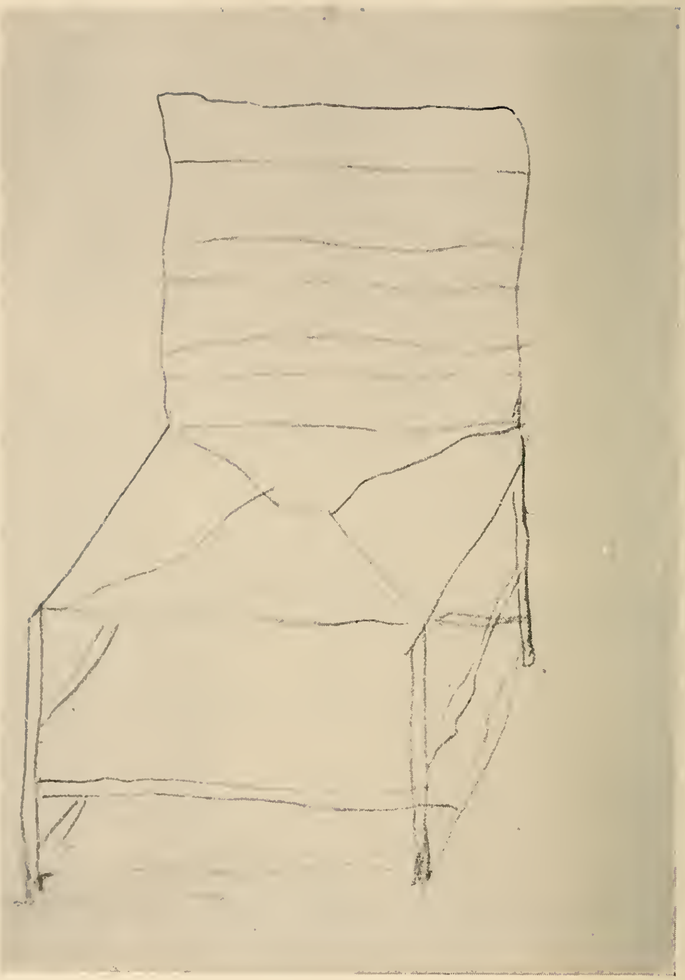


Figure 4. Drawing of a chair from a model: Case No. 4

not self-conscious about the drawing as are many normal adults, but was simply unable to represent many of the necessary parts in their correct relationships (Figure 2, page 174). At the end of four minutes he had finished the head and face, which were crudely but adequately done, the shoulder lines, the arms, and one very sketchy hand; he seemed to be unable to decide how the arms should be represented in relation to the body or how to construct the rest of the drawing, and could not proceed further.

Working very slowly and taking plenty of time to analyze his path, the patient reached the median of the normal group in tracing the *Porteus Mazes.* He would probably have reached a higher level before the attack. His failures were not the result of insufficient "foresight," but rather of a visual analysis of the maze which was inadequate in spite of the time spent on it.

Foreign languages. A professor of Romance Languages, the patient had studied the following languages in the order named: German, Greek, Latin, French, Spanish and Italian, Old French, and Arabic. Apart from English, his mother tongue, he thought that he had been most proficient in Spanish, next in French, and next in Italian. German he had known well twenty-five years before, but had not spoken or written for that length of time. He read Italian fluently at the time of his attack, but had not conversed for many years. Spanish, French, and Old French were the languages he was teaching.

When the examination was begun, during the third month after the attack, the patient's familiarity with the Romance Languages was apparent from a study of his English responses. Names of objects, colors, or other words sometimes came to him first in French or Spanish. French or Spanish constructions often appeared in his written and sometimes in his spoken expression in English. When questioned about these he usually failed to recognize that the form was wrong as an English structure. When writing words to dictation he sometimes slipped over from the English word to a similar word from one of the Romance Languages.

The condition of his Spanish, French, Italian, German, and Latin was studied by the use of language examinations prepared for high schools and colleges, and by having the patient read and write in these languages and translate from them into English. When he was writing very simple letters in English, such as that quoted on page 167, and making occasional mistakes in spelling and sentence structure, his letters in Spanish and French were equally simple and contained a few spelling errors or awkward constructions. The improvement in the written Spanish and French products seemed to parallel that of the English very closely. A German letter, attempted first in the fifth month, contained no errors but was very short and simple. An Italian letter of the same period was more complex than the German but inferior to the Spanish and French letters of the time.

Reading tests similar to the Gray Oral Reading Tests, containing three paragraphs of fifty words each, were constructed in Spanish, French, Italian, and German. The relation shown by the first tests, in the fourth month after the attack, persisted during later tests with different material; English was always read more accurately and rapidly, Spanish next with French a close third (see Table VI).

In other languages as in English, No. 4 at first read in a rather monotonous voice, and separated the words unnaturally. He not only made mistakes in pronunciation in all languages but he was unable to maintain the characteristic inflection as he must have done before the attack. He was so much disturbed by his loss of accent in French and Spanish that he planned to return to these countries so that it would come back to him. He never needed to carry out this plan, however, for his accent returned gradually.

Translations from Spanish, French, and German were at first very imperfect. No. 4 used a dictionary in translating German, but he rarely had to look up the meaning of a French or Spanish word. His chief difficulties were in understanding grammatical constructions and rendering them in English, and occasional defects persisted when his English structure alone was almost free from error. Translations from Spanish and French, however, improved rapidly; the patient used this type of work as a practice exercise with the idea of improving his expression in English.

TABLE VI

RECORDS OF FIRST ORAL READING TESTS: CASE NO. 4
(150 words)

LANGUAGE	TIME	ERRORS
English (Gray III)	75″	6
Spanish	138″	11
French	150″	15
Italian	205″	19
German	225″	25

Most of the standardized language tests were satisfactory indices of his ability in the narrow sense of the word; that is, they indicated his comprehension of sentence material, his knowledge of vocabulary and of grammatical and idiomatic structures, and his ability to translate into English or to express himself in the foreign language in question. At the same time they naturally showed little of his *Sprachgefühl* or of his philological understanding of languages. It is probable, however, that there were limitations in these higher conceptual realms just as there were clear disturbances in the actual language processes, and just as there were limitations in the more complex intellectual functioning in English.

Although they were useful in so far as they showed a poor performance, the results of the Spanish tests could not be compared with those of other tests because the patient had known the former so well before his attack. Thus, while he ranked higher in comparison with the high-school student on the Spanish tests than on the French, the difference might not have indicated a true difference in ability. The German and Latin test results clearly showed a poorer performance than the French and Spanish.

The foreign languages, like the English, were disturbed in particular ways, and those performances which suffered most in English were also most severely affected in the foreign languages. Spontaneous writing and translating from English into the foreign tongue were most affected. Translating from the foreign tongue into English was usually less difficult. In each foreign language as in English, the patient understood far more than he could express; his rating on sentence comprehension tests was always higher than his rating on composition tests. As in English, too, his recognition of word meanings as indicated by his scores on vocabulary tests was again superior to his recognition of the meaning of sentences.

On the whole, then, the language studies made several points clear: first, the generality of the disorder which affected all languages; second, the ranking of the languages, from the point of view of qualitative and quantitative superiority, in order as the patient himself thought he knew them best—English, Spanish, French, Italian, and then classical Latin and German below these; and third, the qualitative similarity of the disturbances in each language with the expressive and constructive processes most severely affected and the receptive least changed. From the third month after the attack, when the first studies in foreign languages were made, to the twelfth month there was a very marked improvement in these languages as there was in English. The improvement seemed to be gradual and no more prominent in one language than in another. In no case did the patient regain what might be presumed to have been his former level.

Further course of the disorder. The progress of this case during the ten months of observation, that is, from the second through the twelfth month after the disorder, consisted of a gradual, regular, and very marked improvement, which was not, however, sufficient to bring the patient back to the levels he must originally have attained (see Figure 1, page 162). The greatest improvement appeared in those performances at first most seriously disturbed, in expression in speech and writing. By the end of the period of observation, therefore, all performances showed more equivalent degrees of disturbance, and the specific character of the disorder was disappearing.

During the ten months of observation, except for a vacation in the seventh month, the patient worked with the examiner three hours a week and spent half an hour to an hour a day by himself in preparatory work. The hours were too few to introduce all the work which might have been desirable but a certain amount of training was accomplished. The nature of the training varied at different periods according to the patient's condition and most pressing need.

When first examined, he could not hold a pencil with his right hand and could not write with his left. His articulation was poor and his written and spoken expression both very inadequate and handicapped by poverty of words and structural defects in the sentence. His work was therefore concentrated on two lines. First, he was asked to read aloud with the idea that his relatively free and accurate articulation in reading might well be utilized as an indirect aid to the difficult articulation of spontaneous speaking. The effect of the reading practice cannot of course be determined, but reading improved in rate and accuracy, and spontaneous speech became easier and more clearly articulated. The second part of the work was special practice in writing, always, of course, with the left hand. The patient was given first one, then two, and later three words and asked to construct a sentence around each set of words. Within two months he was able to write with fair ease at about one-third the normal rate and to construct sentences which were fairly complex and accurate and always far superior to his earlier responses. A random sampling of these sentences is presented in Table VII, pages 180–181. Although only two examples of each day's work are given, the improvement is evident.

Since the written expression had improved so much and since the patient had begun to create practice for himself by writing letters to his friends, the sentence construction was discontinued after about two months. In its place was substituted translating from Spanish, French, or Italian, a form of practice which the patient enjoyed and which seemed a valuable exercise for his expression in English. Oral reading was continued and the passages chosen were simple prose or else poetry selected particularly for simplicity of line and rhythm. The patient, whose voice was rather monotonous and whose speaking was still hesitant and disjointed, could maintain simple rhythms in poetry with comparatively little practice.

The new work begun at the end of the third month of study might well have been introduced at the end of the second but would have been impossible before that. After reading and recounting several stories which he knew well, the patient read articles from newspapers and reported one article at the beginning of almost every work period. The reporting was useful as a transitional stage between reading aloud when the material was produced directly from the text and speaking propositionally when creative mental activity was most essential. The results of these reports are presented graphically in Figure 5, page 179. In view of the varying difficulty of the material, the rate of reporting, as measured by the average number of words per minute, changed comparatively little from day to day; the average number of errors (verbal omissions, repetitions and confusions, and false starts and corrections) was small and showed a slight tendency to decrease in the later months.[4] The curve showing the num-

---

[4] The reports were almost all abstracts of articles by foreign correspondents in the morning paper. While the articles undoubtedly varied in difficulty a certain equality may be assumed, for they were all the patient's own selection and he would not have chosen material beyond his grasp.

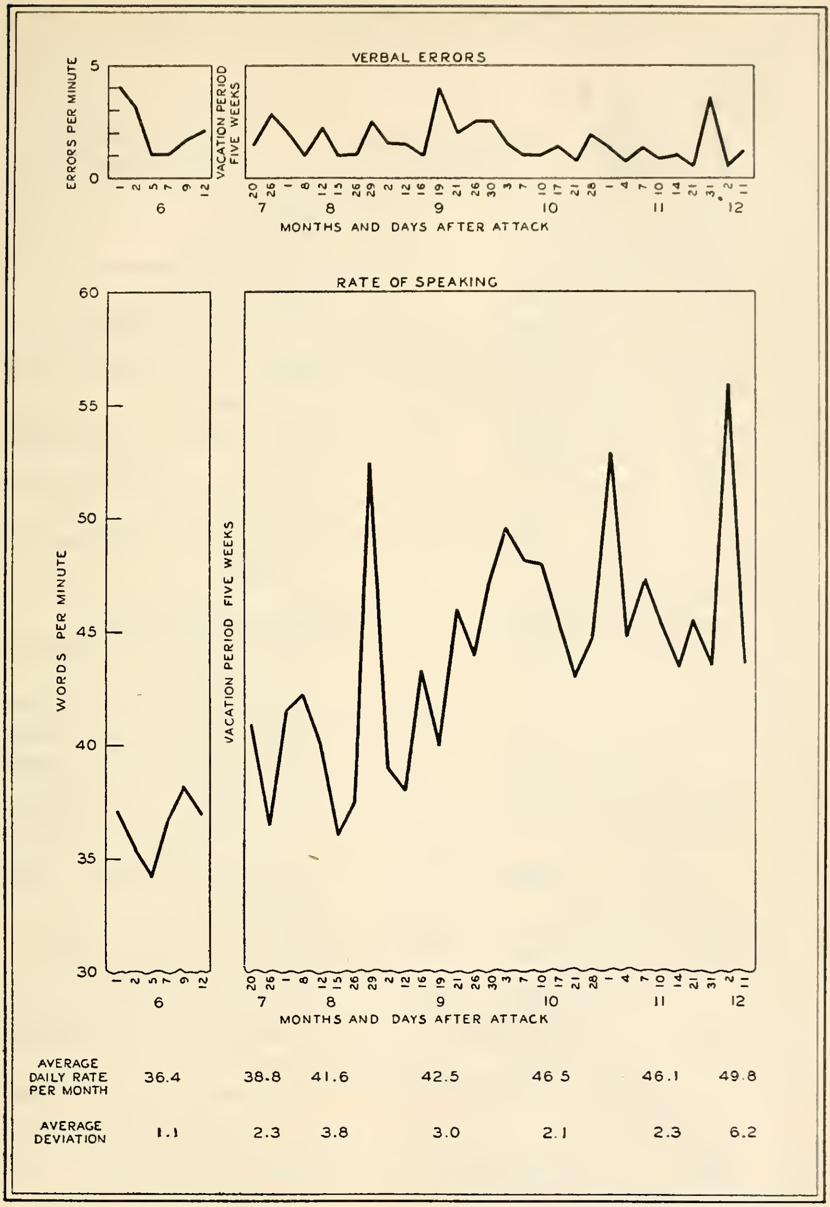


Figure 5. Performance in reporting newspaper articles: Case No. 4

TABLE VII

PROGRESS IN WRITING SENTENCES CONTAINING GIVEN WORDS: CASE NO. 4

LENGTH OF TIME AFTER ATTACK		ITEM IN DAY'S LIST	GIVEN WORD OR WORDS	SENTENCE WRITTEN BY PATIENT
Month	*Day*			
2	29	1	air	cold air
		6	bird	The birds fly.
2	30	1	name	My name is Jones.
		6	picture	I find the same picture.
3	4	1	afternoon	What have you done this afternoon?
		6	basket	Who brought up this basket?
3	6	1	hole	We have made few *hole* in the ice.
		6	interest	I am very much interested in football.
3	9	1	loss	My loss is your gain.
		6	middle	He met me in the middle of the path.
3	11	1	noise	What a lot of noise you *have!*
		6	object	He is the object of my scorn!
3	14	1	pleasure	I am glad to have the pleasure of meeting you.
		6	queen	The queen of Belgium is very handsome.
3	16	1	shoe	I have four pairs of shoes.
		6	size	What size are these?
3	21	1	air blow	It will blow and we shall have snow.
		6	bear run	The bears and the bulls stand the run on the bank.
3	26	1	hand lead	Lead me by the hand.
		6	land must	The land must be sold.
3	29	1	power put	Put on power.
		6	sight is	His sight is dim.

TABLE VII (*cont.*)

LENGTH OF TIME AFTER ATTACK *Month*	*Day*	ITEM IN DAY'S LIST	GIVEN WORD OR WORDS	SENTENCE WRITTEN BY PATIENT
4	4	1	act afternoon	We have rehearsed all the first act this afternoon.
		6	bottom catch	I caught an eel on the bottom of the lake.
4	13	1	pipe match smoke	I have my match so that I may smoke my pipe.
		6	tree leaf flower	The trees bear tiny leaves and the flowers appear also in the month *in* April.
4	16	1	away country follow	The country *follows* along, but away in the distance a farmhouse appears.
		6	rock soon see	We shall soon see a rock which will mark the site of the battle.
4	23	1	business sold famous	A famous business will be sold next month.
		6	rise price today	Prices have risen today on the Stock Exchange.
4	27	1	important tomorrow plan	An important plan will be discussed tomorrow.
		6	separate piece find	I found the separate pieces in a garage.
5	2	1	heavy deliver quantity	We deliver heavy *quanties* of goods.
		6	news events Europe	News events are constantly heard in Europe.
5	7	1	rank range small	On the vast ranges a small object has an inconspicuous rank.
		6	succeed success nothing	Nothing succeeds like success.

ber of words per minute rose gradually; the average monthly rate increased in each month, with the exception of the eleventh, so that over a six-month period the patient made a gain of about ten words per minute.

The oral reading, translating, and reporting were continued during all the later months, and one new type of practice was introduced for the last four months. The previous work had been concentrated on the expressive difficulties. The new work was an attempt to get at the slighter receptive difficulties. The patient listened to the reading of a long sentence or short paragraph, and tried to grasp the essential ideas sufficiently well to present them orally or in writing. When more than about twenty words were read so that the patient could not simply reproduce the material in the formulations given, he still did very well with straightforward statements; he failed, however, when these were very complicated or when they were subtle or involved some play on words.

4. OTHER VARIATIONS WITHIN THE EXPRESSIVE DISORDERS: CASES NOS. 50 AND 6

The first case reported, No. 33, illustrated the relatively simple type of expressive disorder in which the most prominent features were difficulties and errors in articulation and the chief complications were slight limitations in receptive functions and in "higher" language performances. Although the differences were in part a matter of proportion and emphasis, No. 4 presented quite another picture. Difficulties in articulation were less prominent. Evidences of word-poverty were less general: words could be produced under simple and direct controlling conditions, but constructive, synthetic mental activity was difficult in language performances, and in non-language as well. Thus the change in the case of No. 4 took on more of the nature of a basic disorder in mental functioning, while that in the case of No. 33 was rather a simple disturbance in the executive mechanisms and the expressive functions of language.

Together these two cases illustrate, on the one hand, differences which may exist in the specificity and generality of the disorder, and on the other hand, the various particular changes characteristic of the predominantly expressive disorder. Many cases, however, diverge rather widely from these in the extent of the expressive disorder, the quality of speaking in comparison with writing, and the degree to which receptive functions are affected.

Two additional cases will therefore be reported: the first as an illustration of a very severe disturbance in speaking, while writing and other language processes were relatively little affected; and the second as an illustration of a much more general disturbance occurring in a case which was still "predominantly expressive."

The first case, where the speech disturbance was so pronounced in relation to any other change, more nearly approaches a so-called pure motor aphasia than any other examined. As the record shows, however, the disorder actually extended to writing, receptive functions, and higher language processes.

No. 50. *A case of predominantly expressive disorder in which speech production was particularly difficult and disturbances in other language processes slight. The lesion was probably an embolism in the left middle cerebral artery, largely in the motor area.*

Female, white, 33; typist; two years of high school; right handed.

Psychological Summary

The aphasia was predominantly expressive with the most serious disturbance in the production of speech sounds. Many sounds could not be articulated at all, particularly in the first week of the study, and almost all words were defective. The fact that the disturbance centered on the production of speech sounds rather than on word-formation was apparent from the relative excellence of the patient's writing. She made occasional mistakes, but her scores on dictation tests were above the medians for the normal group.

The disorder was not confined to expressive processes, however. Her comprehension of printed material was clearly affected and on language intelligence tests she failed to reach the levels expected of a person of her intelligence and education. Figure 6 (page 184), where her performances are represented in terms of deviation from the medians of the normal group, shows the great difficulty in oral reading and the high level of writing. It is not by any means a complete record of her standing because the very serious disturbance in the production of speech sounds can be indicated only by the low level in oral reading.

The patient was too weak to attempt non-language tests.

She fatigued rapidly in all the work, but cooperated excellently. She would work for a short period, rest, and work again. She had good insight into her disorder and was eager to use all available means to overcome it.

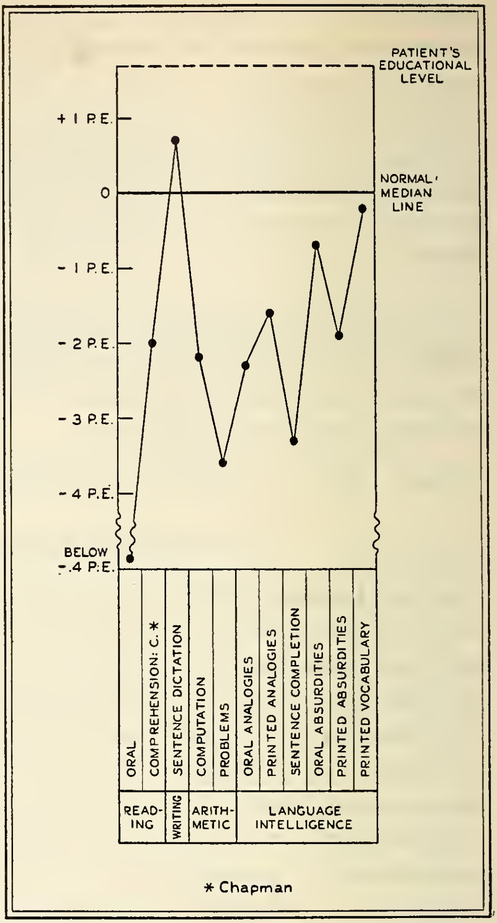


Figure 6. Performance levels: Case No. 50, expressive

She would try to learn difficult sounds by imitating the correct positions shown by the examiner, and when she could not produce a sound, she would point to it on a printed alphabet which she kept beside her. She was interested in the life of the ward, and anxious to take part in general conversation. Her comments were very apt. Once, for example, when asked whether she slept well, she shook her head and pointed to the letters EDISON on her alphabet, indicating that like Edison she did not need much sleep.

Neurological Summary

A young woman with a previous history of cardiac disease, who had gone to bed one evening in apparently good health, awoke during the night unable to move her right side or to speak. The following day on admission to St. Joseph's Hospital, service of Dr. Flynn, the heart was found to be enlarged, with a mitral systolic murmur; the whole right side of the body was paralyzed; the limbs were at first flaccid but later the leg became spastic, with increased reflexes and Babinski. For a few days there was a slight conjugate deviation of the eyes only to the right, and the tongue was deviated to the right. There was at first a suspicion that sensation and vision were disturbed, but this was never definite.

She improved at first, but later developed a pneumonia from which she died six weeks after the onset of the paralysis. No necropsy was obtained. All serological tests were negative.

The aphasia was apparent immediately after the onset of the hemiplegia and the psychological studies were begun ten days later.

The most probable diagnosis was an embolism in the left middle cerebral artery, the lesion being largely in the motor area.

Psychological Report

SPEAKING. For the first four days after the attack No. 50 was reported to be unable to speak at all. On the fifth day she could say "no" and a few other words and speech sounds. When the psychological studies were begun on the tenth day, her *spontaneous speech* was limited to a few words. Only "yeah," "no," "well," and "what" were distinguishable. She had already been given an alphabet printed in large letters to which she was accustomed to point to spell out words. She could articulate the sounds represented by a number of these letters, notably A, B, C, D, E, I, L, N, O, R, and Y. Almost all the words or speech sounds she produced were brought out with great effort, and sometimes several trials were necessary before she approximated the desired sound. She was not always able to correct her errors, however, nor did she always recognize them.

During the next two weeks frequent attempts were made to teach her the various simple speech sounds. At first she had difficulty not only in producing the sound, but in taking the necessary position for it with the lips, teeth, and tongue. Her difficulty could not be called an "apraxia of the speech muscles," however, for she could take these positions either at command or by imitation when she was not required at the same time to produce any sound. The acquisition of new sounds required a great deal of conscious effort on her part; it was not by any means a spontaneous process. During the two weeks of study she learned to produce the sounds "u," "h," "m," "p," "f," "v," "t," "s," and some few of the consonant combinations. She never produced a hard "g" or a "k."

Occasionally a sound appeared easily in some total word-structure which was difficult for her to articulate alone, but for the most part she did better in producing single sounds. She was quite aware of this and often attempted to spell out a word she could not pronounce as a whole. Toward the end of the two-week study-period she had acquired enough skill to attempt to express her meaning in speech. Usually, however, in order to understand anything she said it was necessary to know in advance what she was talking about. Most of the words were produced with great effort and many of them were misformed. Often some one speech sound would be substituted for a number of others. This phenomenon gave the effect of perseveration, but is not to be understood as a typical perseveration. She could produce the sounds "b" and "d," which were substituted for the correct sounds more than any others were, with comparative ease and they therefore appeared when other sounds could not be uttered.

A typical example of her speech appears in her response to the absurd statement: "I read in the paper that they fired two shots at a man. The first shot killed him, but the second one didn't." Her response was satisfactory in content, but very defective in word-formation and articulation.

> Da fur tot it tilled er man, but er tent wer didn'. Well, he wuz died by dur durss dot; ee didn' need er ded un.

The difficulty in articulation made her speech very slow. These twenty-six words required 45 seconds.

The patient could always produce a greater number of speech sounds and words in attempts at *automatic word series* than in spontaneous speaking. Even here, however, her performances were very defective. At first she could count only through "four," and say only "Mon-bee, Doo-bee" in attempting the days of the week. Toward the end of the two weeks' study, she had improved enough so that the numbers and the days of the week were recognizable. She was then asked to try to say the months of the year, with the following result:

> Yan-wary, wed . . . Feb-u-ary . . Martz, April, May, Du, Dudy, Autest, Eb . . e . . tembember, Ottober, Novender, Stedember.

This series required 40 seconds.

Longer responses or easier articulation in *reactive speech* were never observed.

Naming. When first examined, her difficulty in producing words was too great for her to attempt to name objects orally. She was, however, able to write the correct names for the series of common objects and the series of line drawings.

Repeating. It was early observed that she was able to repeat some sounds which she could not produce spontaneously. By this process she learned some new sounds. Often, however, she could not reproduce the sound correctly even after many trials. Words were usually more difficult for her to repeat than single sounds, and phrases and sentences still more difficult. In repeating, her inflection was good. Toward the end of the study she was able to reproduce sentences as long as eighteen syllables, with many words correctly articulated. Even those which were correct, however, were usually pronounced with great effort.

Understanding spoken language. No. 50 was reported to have understood well from the very beginning of the disorder. When the first studies were made ten days later she could apparently follow all ordinary conversation and test directions, but more complex tests showed that her understanding was not entirely normal for a person of her education and intelligence. She failed several of the complex directions of the Abelson Geometrical Figures Test, and even after two weeks she was somewhat below normal in her grasp of the Absurdities. Her speech was of course defective, but her failures with the absurd statements depended largely on inability to grasp the essential point.

READING. *Oral reading* was about as seriously disturbed as spontaneous speech. Her attempts to pronounce simple words made it clear that some of her errors were so far from what she intended to say that they surprised her. For example, she read "din" for "not" and protested that she had not wanted to produce those particular sounds at all. This lack of control of the executive speech mechanisms was characteristic of spontaneous speech as well as reading, but was somewhat more easily observed in reading because the examiner always knew what word was intended.

The patient reported that she had always "read fast, without moving lips," but she was reluctant to attempt tests of *reading comprehension*. When she finally made a satisfactory attempt toward the end of the examination, she had to read slowly, reread frequently, and her score was below the lower quartile of the normal group. Her reluctance probably arose from awareness of her difficulty. No comparable tests were given but it was the examiner's impression that she had a more serious limitation in understanding printed material than in understanding spoken language.

WRITING. The fact that No. 50 was a typist by occupation is undoubtedly a factor in the relative superiority of her writing. She claimed that she had been able to type 85 to 100 words a minute. Ten days after the attack when the examinations were begun she had asked for her typewriter, and was attempting to type answers to questions, names of things she wanted, and so forth. On this day she did all the writing tests on the typewriter, but the next day the typewriter had disappeared, and she explained that she had sent it home because it hurt her hand, the left, to use it. It seemed probable, however, that she had noticed that she made errors in typing and so preferred to have no such means of writing around. All the other writing tests were therefore carried out by the left hand, first in printing and later, as she grew more skillful, in writing.

It was hard to persuade her to write spontaneously. The sentences which she wrote on the typewriter the first day were correct in structure but very short. They contained several errors in spelling. Later sentences were also short and simple, but showed almost no errors in spelling.

On a *word dictation* test the first day when she typed the words, she surpassed the median of the normal group (Morrison McCall Spelling Scale). On a *sentence dictation* test when she wrote the words with her left hand she again surpassed the median of the normal group (Stanford Achievement Dictation). Analysis showed that she could spell many difficult words like "develop," "separate," "committee," "principle" which often cause trouble for normal adults. Furthermore, the errors she made were not the typical normal errors. For example, she wrote:

lelf for *left*
cananatio for *carnation*
chacter for *character*
acquitance for *acquaintance*

On the whole then while her spelling was still superior to the normal median quantitatively, it was somewhat below what would have been expected of a person of her training and on qualitative analysis it showed definite signs of deterioration.

ARITHMETIC. The patient solved short *arithmetic computations,* with ease, whether they were oral or printed, but failed in a long addition or subtraction or in multiplying, for example, a three-place number by a one-place number. Her score for the printed computations was below the lower quartile for the normal group (Stanford Achievement Computation Test). She complained that she had never been able to calculate quickly.

She had even more difficulty with printed *arithmetic problems,* probably in part because of her limited comprehension in reading. Her score fell far below the lower quartile for the normal group (Stanford Achievement Reasoning Test).

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. Almost all the language intelligence tests showed that No. 50 was considerably below the expected level for a person of her ability. The results may have been influenced to some extent by her weakness and rapid fatigue, but great care was taken to give the work in short sections and these factors are not sufficient to account for her poor performances.

On both *Oral and Printed Analogies Tests* she fell just below the lower quartiles for the normal group. On the *Sentence Completion Test* she had even greater difficulty and her score was well down in the lowest quarter of the normal scores. There were interruptions during this test, however, which might account in part for her difficulty. Her performances on the *Oral and Printed Absurdities Tests* were also below the normal medians, but were not so far below. These tests, however, were given about a week later than the others and she had made some improvement during this time.

On the *Thorndike Word Knowledge* where she had simply to choose the synonym from among several words presented, the patient's performance was, as is so often the case, superior to that on any other language intelligence test. Her score was very little below the normal median, and the slight difference could easily have been accounted for by her poor physical condition. It must be noted, however, that her educational level was above the normal median.

REPRODUCTION OF VERBAL MATERIAL. Because of her great difficulty in speaking, no tests could be given for oral reproduction. She was therefore asked to write series of numbers; she could reproduce only five, a performance below that of the normal median.

NON-LANGUAGE PERFORMANCES. Non-language tests could not be given because of the patient's general weakness together with the right-sided paralysis.

The next case, which will be presented to illustrate the relatively serious receptive disturbances which may occur in predominantly expressive disorders, is of additional interest because, during the period of observation, the language difficulties reappeared with the depletion caused by pneumonia and again regressed as the patient's condition improved.

No. 6. *A case of predominantly expressive disorder with marked disturbances in receptive functions as well. The lesion was probably a thrombosis of the left middle cerebral artery involving chiefly the motor area.*

Female, white, 59; housewife; seven years at school; right handed.

Psychological Summary

The aphasia was predominantly expressive, but in the most severe stages there were serious limitations in receptive functions as well. When first examined three weeks after the attack the patient's speech had improved a great deal. A month later her aphasia became very severe, and then again gradually diminished. During the six weeks' observation after the second attack there was not sufficient improvement, however, for her to reach the levels she had first shown.

The findings of the first examination were in brief: hesitancy and occasional slurring in speaking; some difficulty in remembering names and in producing words in controlled association tests, but a fairly rich vocabulary for a person of her class and education; marked slowness in giving the responses to the controlled association tests; satisfactory reading of familiar words when the print was large; immediate reproductions of verbal material which were slightly shorter than the normal but easily and accurately articulated with natural inflection.

A month later when the aphasia was most severe the patient could make a number of speech sounds among which only "yeah," "no," "well," and "why" were distinguishable. At the same time, when given the first items in either series, she could count as high as twelve and say over the days of the week about as follows: "Monday . . Tuesday . . Sens . . Surs . . Friday . . Saddy . . . er Pfum . . er." Furthermore she could repeat more than she could say spontaneously and she articulated words and short phrases and as many as three digits with fair accuracy. When speech was most limited she understood and could respond appropriately by

TABLE VIII

IMPROVEMENT IN LANGUAGE PERFORMANCES: CASE NO. 6

DAYS AFTER REAPPEARANCE OF APHASIA	SPONTANEOUS SPEECH	AUTOMATIC WORD SERIES	NAMING	REPEATING	UNDERSTANDING SPOKEN LANGUAGE	READING	PERFORMANCE ON LANGUAGE INTELLIGENCE TESTS
10	Attempts to answer questions, using a variety of speech sounds produced with great effort. Some few words ("no, yeah, well, may, my, why") comprehensible.	*Counts* through 6 and says the *days* of the week through Thursday when started by first two items in each series. Given "January," can only repeat, and "a b c" can add only "d."	Gives meaningless syllables in which the same speech sounds perseverate.	Repeats 6 or 7 syllable sentences (Ex.: "De dog druns after the cat") but not sentences of 12 syllables. Repeats 4 digits.	Responds well by "no" or "yeah" to short questions in natural situation, but fails 1/3 of Sensible and Absurd Questions. Does not carry out commands.		
15	Attempts longer answers to questions and a few more words recognizable.	Starting herself, *counts* from 1 through 26 and halts from fatigue. Given "Monday," names the *days* in 11 sec. Given "January," says: "January, Feb . . . uary, Mars, um winter, May . . . May" in 30 sec.; prompted by "May June," continues: "June July August, September. . . ."	Names a number of familiar objects, but many names badly formed; and one perseverated, but was rejected when given inappropriately. Cannot name any colors, but selects black, red, blue and green at command.	Repeats 4 digits, 3 letters and 4 disconnected words.	Continues to respond appropriately to simple questions. Follows a few very simple commands.	Reads "the cat and the dog" as "she shike an sont shite"; "the cat" on a 2nd attempt as "thither ann . . . er, shans"; unable to pronounce other words.	

TABLE VIII (*cont.*)

DAYS AFTER REAPPEARANCE OF APHASIA	SPONTANEOUS SPEECH	AUTOMATIC WORD SERIES	NAMING	REPEATING	UNDERSTANDING SPOKEN LANGUAGE	READING	PERFORMANCE ON LANGUAGE INTELLIGENCE TESTS
20	Attempts to ask questions and carry on conversation; speech still very hard to understand. Example: "Yehsink . . . ell . . . bewiss?" (Do I think what?) "Yes . . . erbezz?" (I think you speak better.) "Dessin meant to say!"		Names 6 of 9 Kuhlmann Pictures correctly, but calls the bed "p . . . p . . . purk," the drum "purkvereln" and the apple "melon."	Repeats 1 of 3 of the 12 syllable sentences: "We are gude . . . er gonna have a gude time un eh country."	Fails only 1/10 of Sensible and Absurd Questions.		
23	Clear now that sometimes in answer to direct question or pressing situation she gets word or phrase difficult for her to produce in ordinary conversation.		Hesitates over some of Head's objects, but gets all names. Selects all correctly to oral or printed command. Names 18 of 21 Kuhlmann Pictures but calls the table a "bench," the glove a "hand . . . er foot" and the "cow" a "lamb."	Repeats 4 digits and 4 letters.		Recognizes single words in large print, but cannot pronounce them accurately.	Gives 10 of 20 "easy opposites" in 180 sec. Retains controlling idea throughout list; failures consist of repetition of stimulus word with inability to call up the "opposite."

TABLE VIII (*cont.*)

DAYS AFTER REAPPEARANCE OF APHASIA	SPONTANEOUS SPEECH	AUTOMATIC WORD SERIES	NAMING	REPEATING	UNDERSTANDING SPOKEN LANGUAGE	READING	PERFORMANCE ON LANGUAGE INTELLIGENCE TESTS
27, 28, and 30	Attempts to carry on long conversations, but words still so badly formed that much of what she says is incomprehensible. Example: "How dee do?" (I haven't seen you for several days.) "No . . . er erget . . . er mist you . . . Wed . . . der derfie was askin about you." (The doctor?) "No . . . er datter." (Is it easy for her to get what you say now?) "Yes . . . ere . . . esy to get mut er say . . . quite easy." (How do you feel?) "Oh ye	Says *days* in 13 sec. without prompting. Cannot name first month and says: "You started me before." Given "January," she says the *months* correctly in 10 sec. Asked to say *alphabet,* she starts to count although she knows this wrong. Given "a," goes as far as "p," but omits "h."	Names most colors correctly, but calls orange "red." Some names very poorly formed, less accurate than the object names given before. Cannot say "yellow" and whenever she tries, says "elephant" instead. When she first hears "yellow," says: "Yellena . . . yellena . . . that's no elephant, is it?" Selects colors correctly to oral and printed command.	Repeats sentences of 12 syllables but not of 18.	Understands conversation and answers all ordinary questions correctly. Follows directions well, but range of tests limited because patient can use only left hand, is lying in bed and complains of poor vision.	Understands all color names and reads them aloud correctly.	Gives 10 correct responses (of 50 items) on Oral Analogies Test. Has no difficulty remembering first three words while trying for the fourth; sometimes repeats first three spontaneously.

TABLE VIII (*cont.*)

DAYS AFTER REAPPEARANCE OF APHASIA	SPONTANEOUS SPEECH	AUTOMATIC WORD SERIES	NAMING	REPEATING	UNDERSTANDING SPOKEN LANGUAGE	READING	PERFORMANCE ON LANGUAGE INTELLIGENCE TESTS
	. . . feel fine . . . a wenter er . . . wate . . . wate . . ." (Do you weigh more?) "No . . . I din think I do." (Did you get weighed?) "No."						
41 and 43	Conversation now much more comprehensible, although speech is still accompanied by effort and many words are misformed or poorly articulated.	Says *days* in 6 sec.; *months* in 11 sec.; *alphabet* correctly to "g" but several confusions and omissions thereafter.		Repeats 5 digits, 5 letters and 4 disconnected words. Repeats a series of single words containing all speech sounds and makes very few errors in articulation.	Understanding sufficient for her to grasp a number of easy oral arithmetic problems; score, however, about that of poorest normal.		Gives 14 of 20 "easy opposites" in 130 sec. Gives 11 correct responses (of 50 items) on another form of Oral Analogies Test. Gives only one or two names of objects in each of four classes (animals, flowers, objects made of wood and of iron); suggests no names which are out of place.

"yeah" or "no" to short questions and comments, but when she responded to commands, however simple, she only attempted to repeat the command or made some slight movement with her left hand.

The course of her improvement from this severe aphasia was gradual; usually five to ten days would elapse before there was an appreciable change in any particular performance (see Table VIII, pages 190–193, where progress is reported at intervals as appreciable differences were observed). The progress was regular, with gradual and fairly even changes in any particular performance and simultaneous improvement in other performances.

The improvement in spontaneous speaking and other types of spoken expression was qualitative as well as quantitative; the patient gradually began to form words more accurately. Sometimes she reached the correct form only after many attempts; in trying to say "sit," for example, she first produced "swaite," then "sweite . . . srite . . er . . . ener . . . site . . . site . . . yeah . . . er, sit." She was always able to produce more words and articulate them more accurately in automatic word series and in repetition than in spontaneous speech. Because of her weakness and loss of motor function she was unable to write; an oral spelling test at the end of the examination period placed her below the poorest of the normals.

Neurological Summary

While in the Graduate Hospital under observation for diabetes, the patient developed a partial paralysis of the right upper extremity involving chiefly the hand and forearm. This was followed by a progressive hemiparesis in which the weakness of the hand, face, and tongue was more marked than in the leg. The reflexes were increased and a Babinski was present. Sensation and vision were normal. Speech was disturbed from the onset of the nervous symptoms. Blood sugar was first 294, but was reduced to 111 by the time of discharge. Blood and spinal fluid Wassermanns were negative. The nervous symptoms, which at first gradually increased, receded until about six weeks after the onset, when she developed a pneumonia from which she made a satisfactory recovery but which left her considerably depleted. During this period, both her hemiplegia and aphasia became worse. Gradual improvement followed. The lesion was probably a thrombosis of the left middle cerebral artery.

5. A COMPLEX DISORDER WITH SEVERE DISTURBANCES IN WRITING: CASE NO. 16

Writing which was far superior to oral expression has been illustrated by the case of No. 50. Another case, reported in this section, showed for a time a similarly great discrepancy but in favor of speaking. No. 16 had a very severe disturbance in writing and great difficulty with the formation of letters and with word structure. The writing disturbance was only one of the most serious manifestations of a disorder in the production of spatial structures in many language and non-language performances. Thus No. 16 resembles the various cases showing agraphia, acalculia, and constructive apraxia which have been described in recent years.

No. 16. *A case of predominantly expressive disorder with particularly severe disturbances in writing and in non-language performances of a spatial nature. The lesion probably consisted of encephalitic changes in the left parieto-occipital zones in the course of polycythemia vera.*

Male, white, 40; mechanic; high-school education; right handed, but able in case of necessity to eat and write with the left hand because of injury to the fingers of the right hand twenty years previously.

Psychological Summary

The aphasia was predominantly expressive with a very great disturbance in writing. After a severe initial loss lasting for several days, speaking remained somewhat hesitant, fragmentary, and scanty. The patient understood spoken language fairly well, although he became confused with longer questions or directions and was almost always at a loss with directions involving movements to the right or left, or other spatial orientation. He pronounced words fairly well in reading, but found paragraph reading extremely difficult; his errors indicated that he was unable to follow the sequence of words in the sentence.

Writing was at first almost impossible. As it improved the defects consisted of errors in constructing letters, of abbreviations in the word-form, and confusions in the order of the letters in the word. Similar defects appeared in the arranging of block letters to form a word. Only in spelling the word aloud, that is, in giving the oral sequence of the letters, had the patient retained anything like his former ability.

All arithmetical processes were extremely disturbed, and the defects in reading, writing, and the arrangement of block letters were paralleled by defects in the production of spatial structures in drawing and in other performances not directly dependent upon language. There was then a disorder of mental functioning affecting a variety of performances, language and non-language, which required the production of spatial structures. The constructive processes were always more affected than the processes of recognition or critical evaluation. The patient often appreciated the correctness or incorrectness of the structure he had attempted, and he often indicated that he knew more about it than he could represent in his own construction. The disorder then was "predominantly expressive" not only in that it affected the expressive language processes more than the receptive, but in that it led to more serious changes in the production of spatial structures than in the understanding of them.

During the five weeks of observation the patient improved greatly but was still definitely abnormal. For the most part, the performances most severely disturbed in the beginning were those which showed most marked improvement; thus the striking characteristics of the case were disappearing five weeks after the attack. The improvement is apparent from the crosses and broken line in Figure 7 (page 197), where the patient's performances on first and on last tests during the examination period are expressed in terms of deviations from the normal medians.

No. 16 did not return to Philadelphia after this period and consequently no further studies were made. The letter received by the hospital a year and a half after his discharge showed that his language had improved greatly. His handwriting was easy and flowing, although somewhat untutored; it was much more regular than at the time of the examination. He still made a few errors in letter forms, however, putting, for example, three loops to an "n." His few spelling errors were not unusual, and his sentence structure was good.

The patient always cooperated as well as he could. During the early part of the study he was frequently handicapped by periods of confusion when he would have to look away from his work for a few seconds or a minute. When this confusion passed, he was able to take up his work where he had left it. He was puzzled by his difficulties and anxious to overcome them. He recognized their nature in general but not their extent. His social relationships with the men in his ward seemed to be natural.

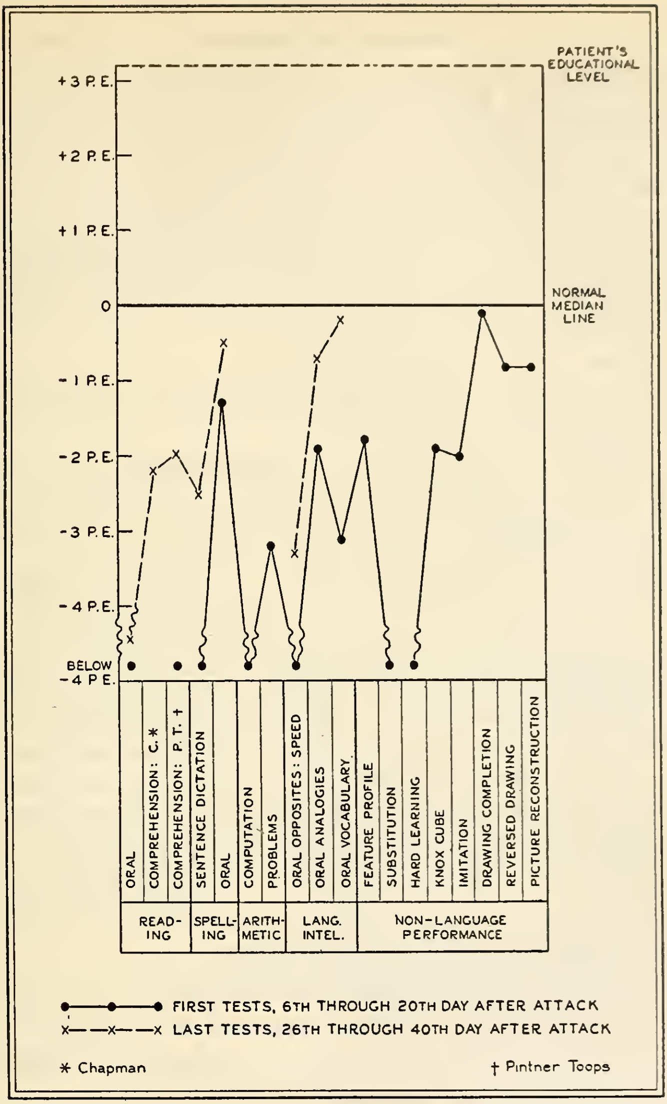


Figure 7. Successive performance levels: Case No. 16, expressive

Neurological Summary

Two months before admission to the University Hospital, service of Dr. Spiller, the patient developed numbness in the median three fingers and median half of the right hand. The numbness gradually extended up the arm to the elbow. At the same time he complained of headaches in the left temporal region. A week before entrance he had had dizziness and spots before the eyes, and two days before admission he suddenly became unable to speak normally; at first he hesitated for words and later could use only single words, but he was able to swear.

Examination on admission showed the right pupil slightly larger than the left, with normal reactions; there was no weakness anywhere, but reflexes on the right were hyperactive.

Examination ten days after the attack showed hypalgesia and decreased temperature sense in the fifth finger of the right hand, and decreased touch sensation over the fourth and third fingers and the ulnar side of the palm and dorsum of the hand up to the wrist. Two-point discrimination was impaired in this region. Texture sense was normal. Stereognosis was impaired on the ulnar half of the hand and not on the radial. There was no weakness anywhere, but the tendon reflexes were hyperactive on the right. There was no Babinski. The visual fields showed beginning right homonymous hemianopsia and enlargement of the blind spots. Fundi showed hyperemic disc on the left and slightly blurred margins on the right.

Blood Wassermann was negative. Blood counts varied from 7,800,000 to 8,900,000 RBC, the white cells showing a variation from 13,000 to 19,200. The hemoglobin varied from 120 per cent to 130 per cent. Differential count showed polynuclear 77 per cent to 88 per cent, lymphocytes 9 per cent to 18 per cent, large mononuclear 3 per cent to 5 per cent.

At the end of two weeks the blood picture was unchanged, but there was improvement in the patient's speech and writing. At discharge four weeks later the red blood count was dropping, the numbness of the right hand had almost disappeared, and speech was markedly improved.

In a letter from the patient a year and a half after his discharge from the hospital he stated that his condition was about the same, but it was apparent that his aphasia had improved.

This was a very unusual case in that the neurological symptoms consisted of a slight irregularity of the pupils; motor symptoms which were limited to a slight hyperactivity of the reflexes on the whole right side with no demonstrable weakness anywhere; and marked sensory symptoms which seemed to be limited to the ulnar fingers and palm of the right hand. These consisted of disturbances in touch, pain, and temperature sensations, two-point discrimination, and stereognosis, and paresthesia in these parts. In addition, in the visual field there was a beginning right homonymous hemianopsia, and enlargement of the blind spot, and the fundi were hyperemic, more on the left than the right.

The lesion probably consisted in encephalitic changes in the left parieto-occipital zones, which occasionally occur in polycythemia vera.

Psychological Report

Speaking. The patient's family reported that at the time of the attack, he first hesitated for words in speaking and later was able to communicate only by single words; he could always swear. When first examined six days after the attack, he answered questions briefly and in a fragmentary fashion. His best *spontaneous speech* was in answer to a question about his handedness in writing:

> I've become left handed . . . with both hands a little . . . bit now. (Since when?) Oh, about twenty years . . . I broke my fingers.

During the second week after the attack he talked little spontaneously except to make such comments as: "I can't do that," or "Getting confused." During the third week these comments became more frequent, and he began to make remarks not directly concerned with the examinations, as, for instance: "I hope to get out of this after a while . . . gettin' Christmas time."

Four weeks after the attack his speech was still hesitant and fragmentary; it lacked the freedom and easy transitions of normal speech. It was, however, extensive enough for the patient to communicate easily in conversation. The following example was typical:

> Now I read along . . . anybody can't follow it. I can't read aloud. Even when I came here, I could read and understand an' everything but nobody else could understand. (Didn't your reading get mixed up at first?) Just a coupla days . . . it was blurred. I couldn't just see exactly . . . but in spells . . . it would come back.

The improvement in spontaneous speech was accompanied by gradual improvement in other speech responses. At the first examination No. 16 could give most *automatic word series* correctly, but always hesitated for five or ten seconds before starting the series. He was unable to start the alphabet, or to finish either the alphabet or the series of months of the year on his first trials. When he had to arrange block letters in alphabetical order, he finally placed all but four correctly; but he required 11½ minutes for the task, and had obviously been uncertain of the position of many letters. Two weeks later he was able to arrange the alphabet in 4 minutes with one letter in reversed position and two pairs of letters in reversed order. When he checked this arrangement, pointing from one letter to the next, he repeated the alphabet aloud correctly and so misnamed the letters of the two reversed pairs, but without noticing these errors. Five weeks after the attack No. 16 arranged all the letters easily and systematically in alphabetical order in a little over a minute. He placed the M upside down, however, and reversed the P, and he did not find these errors spontaneously.

Naming. From the first examination, No. 16 could name objects correctly. He often hesitated, however, before giving the name, and his first attempt at the word was occasionally misformed, as "sivvers" for "scissors." When he tried to write names which he had given correctly aloud, the additional effort and confusion consequent upon the writing led him to make more errors in naming. These errors too consisted of misformed words.

Similarly he named colors correctly, but even when he could write single words fairly well, he made a few mistakes in writing the names. He misspelled some and introduced true confusions in others, writing "green" or "purple" for "blue."

Repeating. No. 16 always repeated words and phrases with correct articulation and natural inflection.

Understanding spoken language. No. 16 understood simple questions and directions. He could pick out the correct pictures to illustrate sentences read to him (Gates Word, Phrase, and Sentence Reading, given orally). When the oral directions were longer or more complicated, he frequently failed (Gates Reading of Directions Test, given orally).

On comprehension tests dependent upon right-left orientation he was at first a good deal confused. He passed only those directions of Head's Hand, Ear, and Eye Test which involved the use of the hand on the same side of the body as the ear or eye. He never crossed the hand to the opposite ear or eye, even though he sometimes repeated the directions aloud correctly. It was significant that left-right confusions were the only errors; the patient never pointed to the ear when directed to point to the eye or vice versa. When reexamined during the fifth week after the attack, although he made only half as many errors as before, his difficulties still appeared when the hand on one side had to cross and touch the eye or ear on the other.[5]

To the spatial directions of the Kuhlmann Comprehension Test, Year VIII, the patient at first could not respond at all; he could give no reason for his failure other than that he was "confused." Successive repetitions of the directions and demonstrations did not clarify the problem for him. Four weeks after the attack he failed the first direction, but when it had been corrected and demonstrated, passed all the remaining five. The improvement also appeared on the Abelson Geometrical Figures Test where he pointed out almost as many correct positions in the interlacing figures as the median normal score.

---

[5] Unlike many cases of this general type reported in the literature under the heading of parietal lobe syndrome, this patient did not show the finger agnosia described by Gerstmann. He was able to point out given fingers at command and to imitate various finger positions.

Thus during a period of five weeks No. 16 became increasingly better able to follow complex directions, but was still far from normal at the end of the observation. His difficulties were not simply the result of poor understanding of spoken language in general; they were more marked when the problem required a more accurate spatial orientation, and were to be related to the spatial disorders shown in other performances.

Reading. During the first week No. 16 misnamed a few letters in any random arrangement of the alphabet, whether the letters were printed capitals or lower-case letters or wooden block letters. These errors were very few in comparison to the mistakes he made in naming and identifying block letters when trying to arrange them to spell words. The situation was analogous to that described in connection with the naming tests: the patient named both objects and letters relatively well when naming was the only problem, but failed to do so when the problem as a whole was complicated by the necessity for writing or spelling words by block letters.

During the next weeks the patient made fewer errors in naming series of letters in pied text, but he usually omitted some letters in each row and he often confused "b" and "d," and "p" and "q."

Studies of Visual Perception by the Gates Tests showed that No. 16 was very slow in differentiating similar and dissimilar pairs of figures, digit sequences, and words, but that he was no worse with one form of material than the other and made no consistent or regular errors.

Six days after the attack No. 16 had difficulty in *reading aloud* many single words within the level of a person of his education and experience (Gates Pronunciation Test). This performance was, however, far superior to that in paragraph reading. He could not finish a simple paragraph reading test of 150 words because he "got balled up" (Gray Oral Reading Test, Set II). In reading the first 75 words, he hesitated frequently and four times stopped altogether. Yet when the examiner pointed to the next word he could pronounce it. In part his reading difficulties no doubt depended on the periods of confusion which appeared in all of his work in the early weeks, but these were neither lasting nor frequent enough to account for his general retardation and his many errors.

The types of errors which appeared in his first paragraph reading persisted throughout later attempts, with the total number of errors gradually decreasing. Word omissions and substitutions were far more frequent than the normal, while mispronunciations, the most common normal error, hardly appeared at all in the case of No. 16. Their rarity seemed a natural consequence of the simplicity of the material, but the material was in actual fact so difficult for the patient that he read very much more slowly than the normal and made many more errors. His errors and his general behavior in reading, his pauses, and his inability to continue until the examiner pointed to the correct word, all indicated difficulty in following closely the sequence of words of the text. In view of this difficulty it was natural that he should have reached a higher level in reading a list of single words than in reading sentences and paragraphs. His many word omissions in paragraph reading (37 per cent as against the normal 12 per cent) were particularly interesting in connection with the large proportion of letter omissions in writing. Furthermore, the nature of the reading difficulty, characterized as it was by a tendency to lose or abbreviate or distort the sequence of words in the text, was apparently related to the spatial disturbances which appeared in other language performances, notably writing, and in non-language performances.

Although the nature of the errors did not change during the period of observation, the patient's oral reading showed clear improvement (Table IX).

TABLE IX

PROGRESS IN ORAL READING: CASE NO. 16

	GRAY ORAL READING PARAGRAPHS (Sets increase in difficulty from I through III)						GATES PRONUNCIATION TEST
DAYS AFTER ATTACK	SET I (50 WORDS)		SET II (150 WORDS)		SET III (150 WORDS)		(100 WORDS)
	Time	*Errors*	*Time*	*Errors*	*Time*	*Errors*	*Words correct*
6			100″*	21*	(Cannot read)		85
17	21″	0	165″	15			
25					145″	11	
34					125″	11	94

* Only 75 words read.

On the seventeenth day the patient also attempted to read paragraphs reflected in a mirror, but with very little success. He had to spell out almost every word and even then often failed to recognize it.

No. 16 was far below normal in his *understanding of printed material.* He recognized common words and could select the correct one to represent a given picture in almost every case (Gates Word Recognition Test). He could also select the correct picture to illustrate phrases and sentences (Gates Word, Phrase, and Sentence Reading). Even for this very simple reading, however, he required as much time as the primary school child. When he had to follow printed directions given in sentence and paragraph form by marking a part of the accompanying picture in a specified way, he did less well than he had done with similar oral directions (Gates Reading of Directions Test).

Four weeks after the attack and again a week later, No. 16 was asked to read a series of short paragraphs each containing one word which did not fit in with the meaning of the paragraph. On each test No. 16 could find the unsuitable word in only seven of the paragraphs, and thus fell in the lowest quarter of the normal group. He often seemed to understand the general meaning without being able to select the specific wrong word (Chapman Reading-Comprehension Test).

Writing. The patient complained that his *handwriting* was not nearly so good as it had been before the attack. Although he wrote slowly and with great care, even after several weeks' improvement, many of the letters were misformed and the product as a whole was very irregular. There were often letters and words which he could not start and many others which caused him to hesitate for some time.

Spontaneous writing was scarce; it increased considerably throughout the five weeks of observation, but at any stage it was very much more difficult for the patient as a means of expression than speaking was. He was reported to have been unable to write anything immediately after the attack. When first examined six days later, he wrote his name correctly, but could write nothing else. On the seventh day, he was able to write the name of his home town as well, although one of the letters was misformed. He began the names of the hospital and city to which he had come, but after two or three correct letters, confused the next ones and was unable to finish either name. At this time his attempts were about equally poor whether with the right or the left hand; the letters formed with the left hand were only a little more uncertain. Ten days after the attack he spontaneously wrote a number of separate words, about a third of which were legible. He could identify the latter in reading over what he had written, but he could not suggest what the others had been. Three weeks after the attack he attempted at the examiner's request to write a whole sentence, but although he began two and spent several minutes on each, he wrote only:

I was a
I was a dife ——

Not until almost four weeks after the attack did he write complete legible sentences. The longest and best of these is reproduced in Figure 8, page 206.

The errors here were typical, misformed "b's" which looked like "f's" and letter omissions. The patient was unable to write any more at the time than that recorded above. He wrote slightly longer passages later during the last week of observation, but none which differed very much either quantitatively or qualitatively.

Eight days after the attack, No. 16 had difficulty in writing single *letters to dictation,* failing more often with small script letters than with capitals. Some few of the small letters were misformed, but most of the failures were complete; the patient could not make any part of the letter. Usually he could substitute the correct capital letter, and he sometimes wrote the capital in the attempt to write the small letter. When this happened, however, he recognized the letter as a capital and said that it was wrong. Some few errors in writing both capital and small letters to dictation persisted three weeks after the attack. On the whole he made fewer letter errors in writing single letters to dictation than in the course of writing words. As in some of his other work, the more complex performances generally led to errors in those parts of the performance which, by themselves, had shown little disturbance.

No. 16 could write single and two-place numbers to dictation. He began to fail with three-place numbers and often made errors with four-place. His responses were generally hesitant. When the same number was dictated first as so many hundreds and then as so many thousands, he treated each as a new problem.

TABLE X

DICTATION AND SPELLING RECORDS: CASE NO. 16

	MORRISON MCCALL SPELLING (Single words)			STANFORD DICTATION (Sentences)	GATES ORAL SPELLING
DAYS AFTER ATTACK	*Form of test*	*Words written correctly*	*Words arranged correctly from block letters*	*Crucial words correct*	*Words correct*
6	1	0		0	20
7	1	1	1	0	
8	2	3	1		
10				0	
13	3	6		3	
19	4	13	18		
22				23	
26	5	23			
29				33	24
38	6	26			

Six days after the attack, No. 16 wrote only a few letters of the *words or sentences dictated.* The next day he wrote one word correctly, and the next day three. He was no more successful in arranging a series of block letters to form the word than in writing it, but he could usually spell it aloud correctly. The striking superiority of his oral spelling appeared again and again throughout the five weeks of study. During this period there was marked improvement in writing to dictation (Table X).

The scores in Table X represented the total number of correct words in each type of test. These raw scores were the best indices of the gradual improvement in writing to dictation, but not of the relative levels in writing words or sentences or in spelling aloud. In comparison with the normal performances No. 16 was more successful in writing single words to dictation than in writing sentences, and more successful in spelling words aloud than in either type of writing. Only in the oral spelling did he reach the lower quartile of the normal group.

Although his performance was always poorer on the sentence than on the word dictations, he made the same types of errors in each. The misformed letters have already been mentioned in connection with his spontaneous writing; they constituted 37 per cent of his errors. In many cases, after one or two letters of the word had been written correctly, the remainder were illegible. Aside from these, the misformed letters consisted of "m's" made with four loops, "n's" with three or only one, "d's" written hesitantly and sometimes rewritten as "g's," and "b's" made with a long loop at the bottom so that they were exactly like the script "f." The patient did not confuse the letter "b" with the letter "f" as he did "d" with "g," but was simply uncertain of the structure of the small "b." Apparently in making a "b," he made the downward stroke too long, without realizing his error either by the kinaesthetic sensations from the movement or by the appearance of the letter. He realized that the small "b" was difficult for him and often substituted a capital "B," but he never corrected his error in the formation of the lower-case "b" spontaneously.

Actual spelling errors were frequent. In the beginning easy words, and later more difficult ones, were so grossly misformed as to defy recognition (22 per cent of the errors). Of the slighter errors, involving one or two letters in the word, the most frequent were letter omissions. This finding was interesting in connection with the frequency of the word omissions in reading. In both language performances this patient's errors were unusual, indicating tendencies toward an abbreviated response and disturbances in order and sequence.

These defects appeared in very simple as well as in more complex words. In writing the word "two" to dictation, the patient wrote "wo" and said: "Kinda funny looking." When this attempt was covered, and he was asked to try again, he printed "TW" and then put "O" in between these two letters. Asked to rewrite the word in script, he wrote quickly "tow," and said that this was right.

His confusion extended beyond writing as such to the *arrangement of block letters* to form a word. It has already been noted that he often misnamed the block letters as he selected them for the word, or as he pointed from one letter to the other to check the word. He could usually recognize the letters singly, but the more complicated performance required in using them to spell a word confused him. In addition to the many failures in which such letter confusions appeared, there were a number characterized by the same disturbance in order as that shown in his writing "tow" for "two." The following response, in which he was finally successful in arranging the letters for the word "man," was one of the best examples of this confusion:

> (Places the letter M and then N, with a space between; 20″.) That's simple, m a n; but how am I gonna put that in? (Pushes M and N together, finds A and places it before M; 45″.) . . . . (Is that right?) (Points to A M, saying) m . . . a . . . oh! (Places M after N.) That's better; I believe it is. . . . . (That's not right yet.) A . . . . (Changes from A N M to A M N and then M A N.) Now, is that better? (120″)

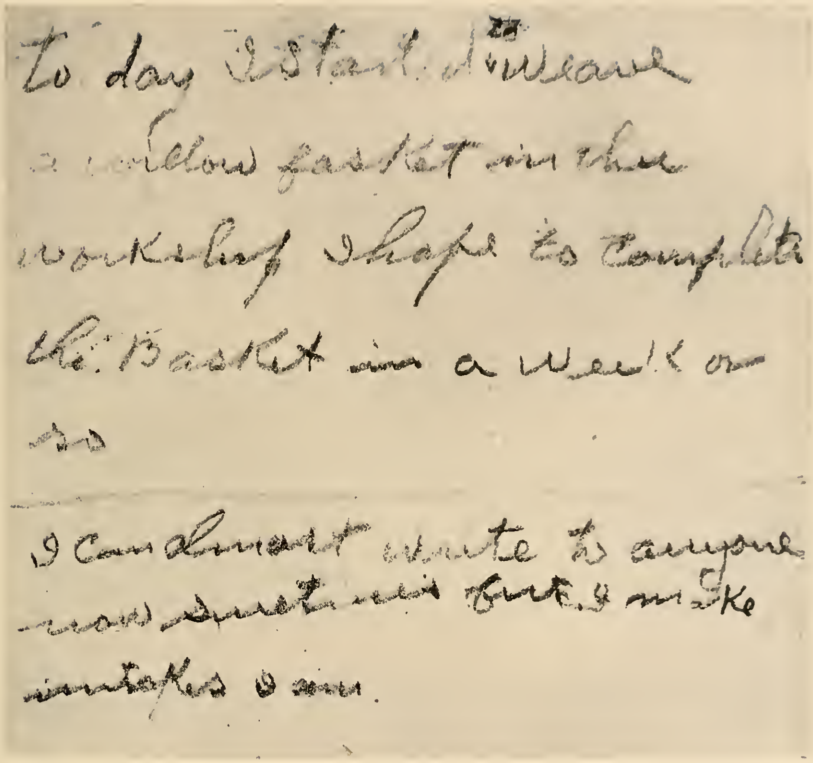
This extreme confusion about the sequence of letters in a very simple word occurred on the nineteenth day after the attack, when he wrote a number of more difficult words correctly. He obviously knew the letters to be included in the word "man," but could not place them in order. Yet he gave the correct sequence orally.

Letter omissions were also found in the block letter spelling. Sometimes the patient discovered the omission as he checked the arrangement, pointing from letter to letter and at the same time saying the sequence aloud. Often when he had discovered the omission and selected the missing letter correctly, he was not sure where it should be placed. And the correct oral sequence of the letters, which he repeated easily, was not a satisfactory guide.

In fact the originally correct oral spelling was occasionally altered by the confusion about the letters written or placed. When he had only to *spell the word aloud,* however, No. 16 from the beginning reached the lower quartile of the normal group. He could even spell such a difficult word as "necessary." When he made errors in oral spelling, they were most frequently letter omissions, but the proportion of this type of error was not so high as in writing.

The great difference between the oral and written spelling seemed to depend on the role of spatial factors in the writing. The patient was confused about the form of the letter, made too many loops or too few, or extended the line beyond its usual proportion. Although he knew which letters composed the word, he could not write or arrange all of them in their correct sequence. The evidence for a primary disturbance in the appreciation and construction of spatial configurations was further supported by the spatial disorders shown in the non-language performances described below.

The patient's difficulty in writing extended to *copying.* He made many errors in copying single words from print into script. He never copied the letters of the printed word by drawing them, as he would probably have been able to do, but tried rather to transcribe the word as a whole into script as he would have done normally. Consequently he misformed letters, omitted and repeated letters, and substituted the wrong ones. Sometimes when he had in mind a word synonymous with that which he was copying, the two were confused in the writing; for instance, in copying "penny," which he usually called "cent," he wrote "pents."



To day I Start to weave
a willow fasket in the
workshop I hope to Complete
the Basket in a week or
so

I Can almost write to anyone
now [illegible] but I make
mistakes I am.

Figure 8. Sample of spontaneous writing: Case No. 16

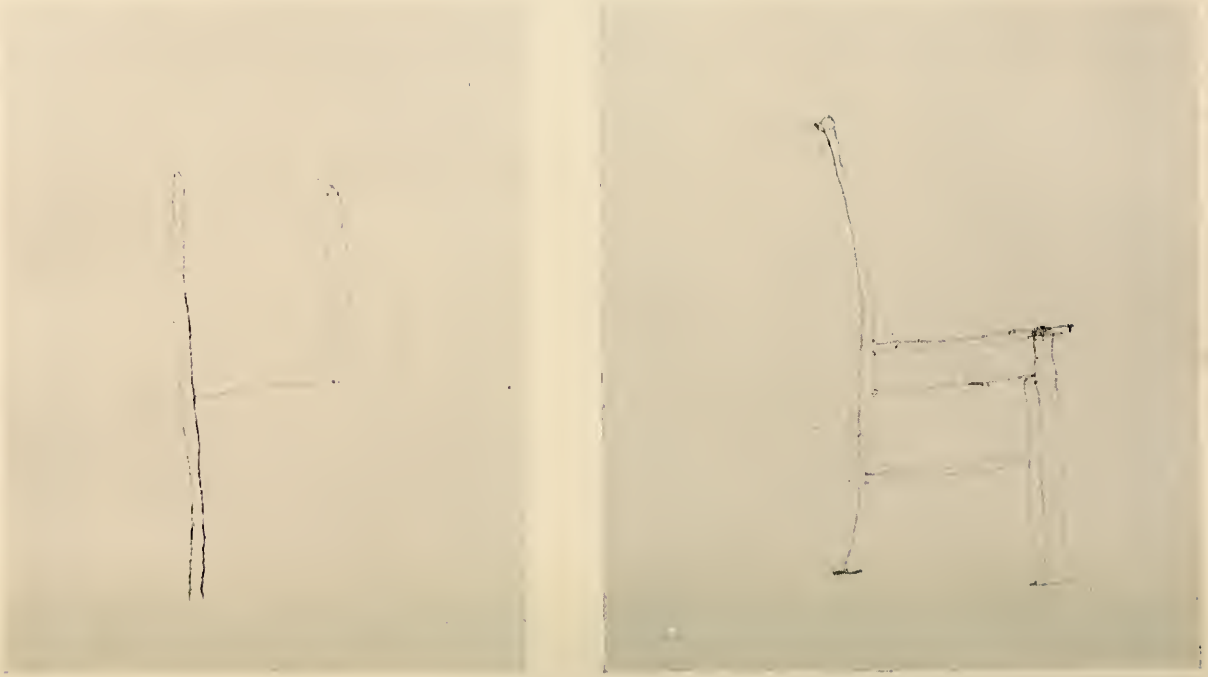


Figure 9. Drawings of a chair from a model: Case No. 16

During the first three weeks after the attack he never copied more than the first few words of a sentence or paragraph; he "got confused" and could not go on. Almost four weeks after the attack when he copied three consecutive sentences, he again had to stop because he was confused; the written product showed an error in about every second word. The errors were either misformed "b's," letter omissions, or letters which were added or repeated; they were, in short, typical of his writing errors in general.

Arithmetic. For a man of his education and training, this patient had extraordinary difficulty in arithmetic. He read numbers without error, until he reached four- or five-place numbers; then he became confused, and, in an effort to group the numbers correctly, would often repeat to himself, "units, tens, hundreds, thousands." Usually this correct sequence did not help him to read the number.

Orally he could give only a few *number combinations,* such as "1 plus 1," "4 divided by 2." He was more often successful when the calculations were presented in the simpler terms "1 and 1," "take away 4 from 5," etc., but even then he could solve only the easiest combinations of the four arithmetical processes, and he was subjectively very uncertain about these. When he tried *printed computations* he recognized only the symbol for addition, although he understood the general significance of the various symbols and knew that he should be able to tell from them which arithmetical process to use. With the printed computations, as with the oral, he could give only a few correct answers, but with the printed he was sometimes able to give the correct sum when one of the figures to be added was a two-place number or when the addition involved three instead of two single numbers. He had difficulty not only with the arithmetical signs and with the number combinations, many of which normally become almost automatic, but with the order and arrangement of the parts of the combination. Given for instance, the problem:

Subtract

$$\begin{array}{c} 7 \\ 4 \\ \hline \end{array}$$

he became confused and could not decide which number was to be subtracted from the other. This difficulty in the arithmetical field was apparently analogous to the spatial disturbances in other fields, particularly in writing.

While the patient's score for arithmetic calculations was below the poorest of the normal group, he was more successful with *arithmetic problems,* and here just reached the poorest of the normal group. He was not appreciably better with problems presented orally than with printed problems. Although he occasionally omitted a word in reading the latter, for the most part he read correctly. He would then repeat the essential points of the problems, sometimes several times. He required one to two minutes to give his answer even to the simplest problems. He usually seemed uncertain of this answer; he would "guess," for instance, that there were ten dimes in a dollar. In solving the problems, No. 16 did simple arithmetical calculations correctly.

Performances on language intelligence tests. At first the patient's language difficulty was so great that he could give only one or two correct responses to simple words of the *Opposites Test.* He was handicapped by word poverty and by retardation and confusion in formulated thought; he would give the first responses correctly and then become confused and be unable to produce any others. Ten days later and again two weeks later he gave twelve or thirteen correct responses on both oral and printed lists of Opposites, thus reaching the lower quartile of the normal group, but his responses were as slow as those of the poorest of the normal group.

Three weeks after the attack he had difficulty producing words under the conditions of the *Analogies Tests.* His scores were almost as low as those of the poorest of the normals, and he required about four times the median normal time. He often repeated the three given words spontaneously, showing that he had no difficulty in retaining them, and yet gave the fourth word wrongly. In many cases it was evident that this fourth word did not stand in the same relation to the third that the second bore to the first, but was simply a "free association" from the third word. The following example was typical of this response:

Country is to road as city is to . . . . *town.*

Other examples seemed to indicate a more positive attempt to control the relation:

Now, that's simple . . . . I ought . . . navy is to sailors as army is to . . . . *land.*

Two weeks after the attack, No. 16 could define about as many words of the *Stanford Binet Vocabulary Test* as the poorest of the normal group. He either gave terse correct definitions or said that he could not answer. Five weeks after the attack he defined correctly almost as many words as the median of the normal group. His expression then was a good deal more free.

Reproduction of verbal material. In reproducing digits, letters, and words immediately after oral presentation, No. 16 at first fell slightly below the medians of the normal group, giving six digits, five letters, and four words. He repeated twenty to twenty-two syllable sentences with ease and natural inflection but he could not repeat longer sentences. After visual presentation he at first reproduced only four digits and five letters. During the fifth week after the attack his repetitions were slightly longer and of more nearly the same length for oral and visual presentations.

During the first week the patient could repeat only one or two fragments of the eighty-two-word story after hearing it three times (Auditory Verbal Memory Test). He was handicapped on the one hand because he could not grasp the points of a passage of this length, and on the other hand because his expression was so limited. When tested again four weeks after the attack he gave nine of the main points, thus finally making an approximately normal response.

Non-language performances. While No. 16 used his right hand for all tests requiring the use of a pencil, he used the left hand most in filling in *formboards*. On the whole, although he was below the medians of the normal group, he worked well on the formboards. His behavior was purposive; the failures occurred in connection with a few form relationships which he never grasped.

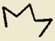
During the first two weeks he was unable to adapt himself to the problem of the *Digit-Symbol Substitution Tests,* even after repeated directions. Three weeks after the attack he completed the Substitution Test of the Pintner Performance Scale, but so slowly that his score fell far below those of the poorest of the normal group. He had to look back to the key every time to find which number to place with each symbol.

On both the *Knox Cube Test* and the *Imitation Test* of the Pintner Non-Language Scale, No. 16 understood that he was to watch and then reproduce the pattern traced by the examiner as she touched one of the four blocks or dots after the other. He succeeded, however, in reproducing only a few of the patterns on either test, and thus fell among the poorest of the normal group. Failures on these tests would be expected when there was any such difficulty in the appreciation of spatial relationships as that indicated by some of the patient's language performances.

Similarly, difficulty was expected in the *reproduction of forms and figures* after a ten-second exposure. Surprisingly enough, No. 16 drew both Binet Designs correctly, thus surpassing many of the normal subjects. He did not match this good performance on other tests, however. He never succeeded in reproducing a series of more than three simple geometrical figures (Gates Visual Apprehension and Memory Span). Four weeks after the attack when he tried to reproduce the lines of the Kuhlmann Test of Immediate Recall, he was far below the normal medians in accuracy and in speed. It was interesting, in connection with the frequency of his omissions in reading and writing, to find that two-thirds of his errors on this test were lines omitted.

When he had to complete the *Reversed Drawings,* making the second one of each pair look like the first "only turned over," No. 16 could finish only the four simplest drawings and again fell below the median of the normal group. In analyzing the given figure and its relation to the one he was to complete, he tried to "keep his place" on the given figure by one or two fingers of the left hand, but this aid was of little value.

No. 16 was not equally poor on all non-language tests. In addition to the fairly good performance with the formboards, he did relatively well with the *Drawing Completion Test,* just about reaching the median of the normal group. While he completed several drawings which were difficult for the normal person, he made mistakes in others, for instance, extending the handle of the umbrella up so far that it seemed to show through the covering. Furthermore, he could tell that the drawing of a foot represented only four toes, and yet he could not find a way to draw the fifth toe. This failure was like some which appeared when he attempted to draw a man and a chair.

During the first weeks he could not "get started" on a drawing of a man or of any familiar object to be reproduced from memory. When he was asked to draw simple geometrical figures, he succeeded in making a square, a circle, a cross, and a triangle, but he could not draw a diamond. Each attempt resulted in a figure like this: . He apparently knew that a diamond had such angles, but he could not arrange these in their proper position in space.

When his difficulties decreased, he attempted many drawings, including a *drawing of a man*. During the fifth week he drew a fairly complete head and indicated the shoulders and one arm, but was unable to finish his picture because he could not "get the idea of it." The head was crude but fairly accurate and detailed. The quality of this incomplete drawing was apparent from the fact that it merited 74 per cent of the points allotted on the Goodenough Scale to the head and shoulders, whereas the average normal drawing received only 58 per cent of the points possible for a complete drawing. In other words, although the patient's score as a whole fell in the lowest quarter of normal scores, he had actually surpassed the normal on the part which he was able to represent. It was therefore all the more surprising that he could not complete the drawing. Only the poorest of the normal drawings were left in such an incomplete state.

In *drawing a chair from a model* the patient had many difficulties. When he first attempted this about four weeks after the attack he worked for five minutes and drew only two sides of the back, one long enough to represent a leg, and a line indicating where the seat should be (Figure 9, A, page 207). He found that he could not "get started," but explained: "I'm willing enough; I want to do it." He was the more puzzled by his difficulty because he had formerly done mechanical drawing in the design of paper mill machinery.

Several days later, when he had privately practiced drawing a chair, he produced a much more complete drawing from a straight side view (Figure 9, B). He was unable to draw a chair placed at an angle so that the seat would have to be represented in perspective. As a matter of fact even in this straight side view, he should have represented the other two legs of the chair. He was interested in the detail of the drawing: the projection of the seat in front and the lines indicating the third dimension showed this interest, and so, too, did a very striking error in the drawing, the horizontal line projecting from the top of the chair back. This line, over which he spent a good deal of time, was an attempt to represent the very slight rounding of the cross-bar at the top of the chair back. The score for this second drawing was near the median of the scores for the normal group, but the drawing was a simpler problem than that required of the normal subjects who saw the chair at an angle and had to draw the seat in perspective.

In *drawing a floor plan* of the ward, the patient got the proportions approximately correct and the positions of the beds and the desk. He failed to indicate doors or windows until he was questioned about them. When he had put these in, he was asked to add the Christmas tree which stood in the center of the ward. He placed it correctly, but drew it as it would have been seen from the door of the room. He recognized his error when questioned, and gestured to show that the tree, too, should have been in cross-section.

The drawing studies were particularly useful in demonstrating the extent of the disturbance. They often indicated that the patient "knew" what he had to draw, but could find no means of representing it on paper. Sometimes he made gross errors, as in drawing the horizontal line to indicate the slight rounding of the cross-bar in the back of the chair. The errors and the very serious limitations were definite evidence of a disturbance in spatial representations. They were to be related to the frequent signs of spatial disorders in the language performances.

In tracing the *Porteus Mazes,* the patient's score fell in the lowest quarter of the normal group. He worked very slowly, spending as long as a minute and a half in preliminary study of the maze. He was not lacking in "foresight"; he stopped at all crucial points and tried to trace an open path. By simply looking ahead, however, he could not find the path in the more difficult mazes; he always wanted to be allowed to trace the path in the air first. The mazes then gave further evidence of the patient's difficulty in spatial adjustments.

6. SUMMARY

The main groups of expressive disturbances are: 1) defects in the articulation and formation of words with more or less marked alterations in the structure of the sentence; 2) verbal and structural confusions resulting in the erroneous use of words or grammatical forms; 3) difficulties in the evocation of words as names for objects, conditions, or qualities.

The first group of disturbances is typical of the predominantly expressive disorder. In severe cases speech may be limited to a few utterances which are likely to be of an emotional, automatic, or reactive rather than a propositional nature. In less severe cases, or when the disorder has regressed somewhat, speaking is still retarded and difficult, and sometimes lacking in the normal inflection; words are poorly articulated or so altered in structure as to be grossly misformed. The expression is usually simplified and fragmentary, but the sentence structure suffers less on the whole than the word structure. The errors which appear in the sentence result rather from the omission of words than from grammatical confusions. Abbreviations so marked as to constitute a "telegram style" are rare.

Disturbances of written expression are usually similar to those of speaking in nature and extent; words are misspelled in writing much as they are misformed in speaking, and the alterations in the sentence structure are very like in either form of expression. In some few cases, however, there is a wide discrepancy between the quality of the speaking and writing. Two cases reported in the chapter illustrate the extent of the difference: No. 50 wrote extensively and with few errors in word-formation when she could articulate only a few words and speech sounds; No. 16 could speak without difficulty in articulation when he could write only one or two words. Furthermore, the essential nature of the two disturbances was very different.

The expressive disturbances in every case were only part of the picture. Even in the simpler cases, illustrated in this chapter by No. 33 and No. 50, there was some limitation in receptive functions and in higher intellectual performances in language terms. Most of the cases of predominantly expressive disorder were more complicated than these. The greater complexity in some cases depended on the more serious disturbances in receptive functions and in higher language performances of various types. Such a case was illustrated by the record of No. 6; here all language processes were greatly affected, but the expressive processes still more seriously disturbed than the receptive.

In other cases the greater complexity apparently depended on a change of mental functioning of a basic order. The specific nature of the change differed somewhat: in the case of No. 4 the disorder was most obvious wherever the performance required the construction of a coherent whole, given a number or perhaps all of the parts; in the case of No. 16 the disorder again appeared in performances requiring constructive activity, but its spatial character was the most striking feature. In both cases the disturbances extended beyond language and appeared in performances not directly dependent upon language.

IX

TYPES OF APHASIA: THE RECEPTIVE

1. The nature of the receptive disturbances
2. The nature of the expressive disturbances in patients of the predominantly receptive group
3. Other characteristics of patients of the predominantly receptive group
4. A predominantly receptive disorder with typical changes in expression: Case No. 31
5. A predominantly receptive disorder with marked difficulty in reading and typical expressive changes: Case No. 22
6. A complex disorder with limitations in receptive processes and particular disturbances in repeating and writing to dictation: Case No. 28
7. Summary

1. THE NATURE OF THE RECEPTIVE DISTURBANCES

RECEPTIVE disturbances, because they cannot be studied directly, must be inferred from the patient's responses to the natural or test situations in which he is observed. It is therefore of great importance that any defects in his language or non-language behavior should be determined, and that means independent of these defects should be devised for testing his understanding. Understanding must not, for example, be judged according to the patient's verbal response when language expression is seriously disturbed; nor should it be judged according to his ability to follow directions when he has difficulty in performing voluntary actions. With adequate precautions it is possible to estimate the extent of the understanding of spoken language or of printed material, the relative efficiency of these two receptive functions, and the type of material most easily grasped. Furthermore, analysis of the patient's responses will usually show something of the nature of his receptive abilities: his perception of the speech sounds or printed symbols, his understanding of specific words, and his grasp of the verbal formulations in their whole significance.

Whatever the nature and extent of the receptive difficulty among patients of the predominantly receptive or of any other group, there is no absolute loss; that is, the patient never regularly fails to perceive the speech sound, nor invariably grasps words or phrases of a certain length and none longer. As in the expressive disturbances, the extent of the defect varies inversely with the familiarity and interest of the situation; patients can often respond adequately to questions about their own affairs when they are at a loss with other questions objectively no more difficult. When the situation is further complicated, if, for instance, the patient is trying to spell or define the word, he often shows more confusion about the word-sound or its meaning than when the receptive process is the only problem.

Additional variations which occur in the patient's responses cannot be attributed to any specific factors. His response to a particular question may be satisfactory at times and unsatisfactory at others. Estimated by the average of a number of responses, however, the quality of his performance may improve or deteriorate but does not usually vary widely from day to day.

Cases of the predominantly receptive group show different degrees of limitation in the understanding of spoken language, differences extending from failure to appreciate the full significance of the verbal formulation down to a faulty understanding of single words or short sentences with some difficulty in perceiving the word-sound. A similar range in the disturbances is apparent from the patient's response to printed material, where difficulty in understanding the meaning is often complicated by defects in the recognition of letter- and word-forms. These defects, like the faulty perception of word-sounds in listening to speech, are more frequent in the more serious cases or in the more severe stages of the disorder, but they have no regular relation to the understanding of the word-meaning. A word perceived in imperfect form may be a satisfactory vehicle for the meaning while a word of correct form may on the contrary have lost its symbolic value.

When the statement as a whole is beyond the patient's grasp, it is often evident that he understands some word or phrase within it and responds on the basis of this. If, for example, the direction "Point to your left eye!" were too difficult for him he might show both eyes, or discourse on the concept "eye." If he were pointing out one of four pictures to illustrate a given phrase or sentence, he would often be confused because that part of the statement he had grasped applied equally well to two of the pictures.

These responses to part of the statement indicate true receptive difficulties. Other limitations arise, particularly in the slighter degrees of disorder, and some of these are not actually "receptive" difficulties, for the material is adequately perceived and its meaning appreciated in the narrow sense. The patient understands the specific terms of the statement, but does not develop from these the further significance of the verbal formulation as a whole. Thus he behaves like the normal person of low intellectual level, and his response can be classed as pathological only when he has formerly been capable of a higher grade of mental functioning. In many cases of the expressive as well as of the receptive groups, the patient understood the specific terms but failed to grasp the further significance of statements he would formerly have appreciated fully.

Some of the patients of the predominantly receptive group were about equally limited in their understanding of spoken language and of printed material; others experienced far more difficulty in the one receptive process than the other. Typical differences appear in the cases described in this chapter: No. 31 with his slightly greater difficulty with spoken language; No. 22 with a disturbance in reading so pronounced as to recall the classical "alexia"; and No. 28 with approximately equal limitations in the understanding of spoken language and of printed material.

2. THE NATURE OF THE EXPRESSIVE DISTURBANCES IN PATIENTS OF THE PREDOMINANTLY RECEPTIVE GROUP

The expressive disturbances characteristic of patients of the predominantly receptive group usually vary in severity with the extent of the limitation in receptive functions. There is, however, no regular relation. Either understanding spoken language or reading, or both, may be severely disturbed when expression is little changed, and expressive processes, on the contrary, may be or remain considerably affected when the patient understands fairly well. In the first condition the disorder is actually "predominantly receptive"; in the second and rarer condition, when the expressive processes may perhaps be affected as much or more than the receptive, the term "predominantly receptive" loses its logical significance, and is retained only because the particular expressive disturbances in question are found chiefly with receptive disorders and play little part in the predominantly expressive aphasia.

One of the most obvious contrasts between expression in the predominantly expressive and the predominantly receptive disorders is in the extent and freedom of the speech. Patients of the receptive group often hesitate because they cannot evoke the necessary word with normal ease and speed, but they proceed quickly to substitute another word, right or wrong, or to paraphrase. Their most striking defects, the verbal and grammatical confusions, disturb the quality and coherence of their expression but usually do not limit or retard the actual speaking. If a patient of the expressive group and a patient of the receptive were each to talk in a tongue unfamiliar to the observer, or at such a distance that he could hear the speech but not understand it, the expressive patient could almost always be distinguished because of one or more of his typical disturbances—retardation, frequent and prolonged hesitations, effort in articulating, or changes in voice tone and inflection. The receptive patient in such a situation would usually seem to be speaking normally. He would probably hesitate for words occasionally and his expression would lack normal continuity and coherence, but the speech itself would issue freely, with natural inflection and usually at a normal rate. Because normal differences between the patients in rates of speaking are probably considerable, comparative rates after the disorder are difficult to evaluate. It is clear, however, that while many patients of the receptive group speak at an approximately normal rate, others exceed the normal. An instance of accelerated speaking is much more likely to be found in the receptive group than in the expressive. Furthermore, the speech is sometimes not only more rapid than the normal but seems to issue under greater pressure.

The defects in expression may appear to about the same extent in speaking and in writing, but they are often more pronounced in writing. Their nature is the same in both types of expression. Although closely interrelated in many ways, for purposes of discussion these defects may be divided into three main groups: first, verbal and grammatical confusions and changes in word-order; second, difficulties in evoking words as names for objects, conditions, and qualities; and third, changes in the form of the word similar to the misformations so often found in the predominantly expressive disorders. The defects in word-form are not usually so prominent as are the verbal and structural confusions or the amnesic disturbances, but some of them appear in the majority of cases and they may be frequent in severe cases. They range from slight defects such as "sair" for "chair," through more serious changes, like the substitution of "hine" for "house" to words so garbled that they lack any resemblance to the true word. Like other verbal substitutions, these word changes are often influenced by the tendencies to perseveration and to contamination of one part of the response by an earlier or later part which are so frequent in the predominantly receptive disorders.

Amnesic phenomena are much more common in the predominantly receptive aphasia than in the predominantly expressive. In most cases of the receptive type, speech is sometimes broken because the patient cannot evoke the necessary word, but his reaction to this difficulty is somewhat different from that of the clear-cut amnesic patient. The latter tends to hesitate and try out a number of words until he finally reaches the correct one. His ultimate success is possible because he usually recognizes this word when he finally suggests it or when it is one of a number suggested to him. The receptive aphasic, on the contrary, does not hesitate so much in speaking because he tends to accept any word, right or wrong, or to paraphrase. He is not nearly so certain in his recognition of the correct word in its symbolic value as is the amnesic patient. Consideration of the paraphrases by which the receptive patient sometimes expresses the significance of the missing word leads to the verbal confusions next to be discussed. It must be noted here, however, that some of these round-about expressions are as apt as the indirect phrases by which an intelligent person, faced with the problem of expressing himself in a foreign language, may try to compensate for some word he does not know. One patient, for instance, substituted "animal of the circus" for "elephant"; and in working on the Sentence Completion Test, he described the sentences containing blanks for words to be added by him as "sentences vacant of completeness." Indirect expressions similar to this are frequently apparent in some of the more complex grammatical changes.

The most characteristic expressive defects of the predominantly receptive aphasia are the verbal and grammatical confusions. These are hardly two distinct types of error; the one shades off into the other, and there are often verbal confusions, such as changes in pronouns or parts of the verb, which lead to grammatical errors. Other grammatical errors, however, may result in a change which is far more extensive than a simple verbal confusion. Another change of syntactical structure appears in confusions of word-order. These are less prominent than the verbal and grammatical confusions, but still a notable characteristic of expression in the predominantly receptive as opposed to the predominantly expressive disorders.

The verbal errors, which will be considered first, are extremely complex, but show certain general tendencies. Some of them are related to the word which should have been used by similarity in word structure, either in the whole word or a part of it, or by similarity in sound. Many others clearly arise on the basis of a sense relation. One patient, for example, complained that he was tired of hospital life because his brain did not get "actuated" there; he apparently used the word in the sense of "stimulated." The same patient said he "agreed the music" for "liked the music," and he used the word "increase" fairly regularly when he meant "improve." In some cases the patient substituted for the correct word one or perhaps a number within the "sphere" of that word. He said, for instance, "store" for "office," or "lawyer" and "minister" for "doctor." Substitutions of this type show a clear controlling principle. An error of a different type appears when the nature of the phrase seems to determine the verbal substitution made. One patient said, "I've been spending a lot of money on this," when he meant that he was spending "time" or "effort." The word "money" thus depends less on a meaningful relation to "time" or "effort" than on the familiarity of its use as a predicate for "spending."

There are of course many verbal substitutions which cannot be attributed to any logical or psychological principle. Some of them would undoubtedly be comprehensible were it possible for the examiner to be completely aware of the situation as it exists for the patient. As a matter of fact, the proportion of incomprehensible errors varies with the case and not altogether in direct relation to its severity. Whether or not actual chance errors are more numerous in some cases than in others, it is certainly true that various determining principles are much stronger factors in some than in others. No. 22, for instance, whose record is reported in Section 5, gave many more verbal substitutions within the "sphere" of the correct word than other patients whose disorders were no more severe, and who were moreover equally intelligent.

For the most part the verbal confusions, like the grammatical confusions described below, issue without hesitation or effort. They emerge so naturally in the flow of speech that they cannot be conscious substitutions for phrases the patient lacks; they are direct expressions of the thought with apparently no more emphasis on the structure of the formulation or the choice of words than in normal speaking. When the confusion has once been uttered, however, the patient may be aware of it and may halt his speaking to attempt to correct it, but often it seems to pass unnoticed and is obviously intended to carry the meaning.

The frequency with which the patient is aware of the errors he has just made and the accuracy of his awareness vary. The more severe cases naturally seem least conscious of divergences from the normal, but there is no direct relation between the awareness and the extent of the disturbance. The lack of regular relation is obvious from a comparison of patients with slighter disturbances and from a survey of the irregularities in any one case. Furthermore, the same type of analysis shows that there is no direct relation between the awareness of the defects and intelligence.

In the most severe cases, the product is incoherent, and the only statements which can be made about it are that it contains true words as well as misformed words, is generally lacking in structural arrangement, and usually shows a good deal of perseveration. When the confusion is less complete, the verbal substitutions become clear and the grammatical changes can be analyzed to a certain extent. The latter may be specific changes, in which case they are really no more than verbal substitutions within different groups of grammatical terms; or they may be very complex changes affecting the whole structure of the expression.

Among the specific changes confusions in pronouns are frequent. The patient, for example, says, "I sat here last night by *himself,*" when he means, "I sat here by *myself*"; or "The woman took *her to me*" for "The woman took *me to him.*" Confusions in verb forms are also frequent, and an incorrect auxiliary sometimes appears. A few defects are clearly substitutions of the wrong preposition or of the wrong conjunction. Other defects, resulting sometimes in simple verbal confusions, appear when the patient alters prefixes, saying for instance: "I have been *refined* to my bedroom." Changes in suffixes are sometimes represented by the substitution of one form of the verb for another or of the adjective for the adverb.

The more extensive grammatical and structural confusions are often difficult to define. Some are changes in word-order with no confusion which could not be eliminated by a rearrangement of the sentence. In the speech record later quoted for No. 22, for example, the patient said: "Only two things with me that are the matter . . ." More frequent than simple changes in word-order are peculiarly indirect expressions such as: "The dinner was enjoyed by me," "I have trees of apples in my yard," or "That work made my mind think differently." These sentences are still comprehensible in spite of the alterations in the habitual forms of expression. They usually do not contain errors comparable to those which would be expected in the formative stages of language; they are rather forms of expression which might have become customary had English developed differently or which might be customary in another tongue. In short, the patient is not really making simple errors in expression, but creating new forms of expression.

Changes in habitual patterns appear not only in these indirect constructions, but in occasional breakdowns within more or less stereotyped phrases. One patient, for instance, "drove up *to the long side* of a car"; another after reading late one night, explained: "I think I must have *done it over* a little bit because I can't read this morning." Another peculiar difference from the normal form appears in the phrase: "at this day in *its* morning."

Indirect and round-about expressions together with substitutions of unusual or metaphorical words for the more customary terms sometimes give the impression of "over-writing." The patient can still communicate coherently, but he has lost the simple and natural forms of expression. It is noteworthy, however, that the individual patient varies greatly from time to time in the type of expression he uses. The extent of the possible variation will be clear from two quotations from letters written by No. 22, the one as devious as the other is direct and blunt:

> 1. I trust I am now learning to do my very best to secure the ideas to put myself carefully to operate the item to me which was seemingly away when needed so much by me.
>
> 2. (A description of the nature of his difficulty after the attack.) Personally I got dumb and could not remember things.

When variations such as this occur in the responses of an individual patient, at about the same period, it is evident that the characteristics of his expression can be described only in general terms, with notes on his verbal and structural confusions, the extent of his amnesic difficulties, and so forth. Typical verbal and structural changes have been outlined above. When all the changes which can be defined have been assigned to their respective groups, there are still many differences from the normal which are so complex and variable that they must generally remain unclassified. Their complication and lack of definition repeatedly bear witness to the complexity of the language disintegration. It is no simple regression along the lines of development; there are few confusions which can be compared to the normal errors at any developmental stage. The disintegration is rather an alteration in language expression, varying somewhat in quality from one situation to another and involving new verbal usages and structural arrangements in which differences from the normal forms may exist without necessarily destroying the value of the expression.

3. OTHER CHARACTERISTICS OF PATIENTS OF THE PREDOMINANTLY RECEPTIVE GROUP

For patients of the predominantly receptive group performances on language intelligence tests have to be studied with care in order to estimate the effects of the difficulties in comprehension and confusions in expression, and subsequently the extent of the disturbance independent of direct expressive or receptive difficulties. The problem is of course simpler in those cases where one of the receptive processes is fairly satisfactory.

As in cases of the predominantly expressive group, failures on comprehension tests sometimes appear when the patient grasps the specific words of the statement but fails to develop its whole significance. In this situation there is an inadequate intellectual performance which is not directly dependent on faulty receptive functions. A different condition which often appears consists of a discrepancy between the higher intellectual performance and the simpler expressive process: the patient shows that he understands the problem of one of the language intelligence tests and can solve it, but cannot express his solution in the correct verbal terms. Responses of this type appear, for instance, on the Opposites Test where a patient may indicate by gesture his knowledge of the "opposite" he cannot name, or give the wrong "opposite" but indicate by gesture or verbal qualification that he understands something of the correct one. Apart from these occasional differences, there is a general tendency for the performances on language intelligence tests to fall around the levels of the receptive and expressive processes, being extremely poor in the most severe cases and increasingly more satisfactory in the slighter cases.

The qualitative differences between the predominantly receptive and the predominantly expressive patients on the language intelligence tests are naturally similar to the differences between the spoken or written expression in the two cases. The receptive patient is more likely to give a confused response, the expressive patient to give no response at all unless he can make the correct one. Moreover, the receptive patient is often handicapped by perseveration, and is also more likely to lose the principle of the problem than is the patient of the predominantly expressive group.

The non-language performances, like the language, vary from low to high, but they have not the close relation to the specific receptive and expressive disturbances which the higher language performances have. On the whole they are superior to the language performances. Furthermore, while many non-language performances may be seriously affected in the most severe cases, one or two may remain relatively high. In many cases there are instances of non-language performances of good quality when the verbal responses accompanying them are extremely confused. A good non-language performance in spite of verbal confusion is a frequent occurrence; a poor one as a direct result of verbal confusion is rare.

Observations of general behavior in patients of the predominantly receptive group showed instances of satisfactory adjustment to practical situations and actual living conditions and other instances of unsatisfactory adjustment and lasting emotional disturbance. There was no general tendency throughout the group. Except for a few very severe cases with extensive deterioration and disorientation, the various conditions generally are well exemplified by the three cases reported in Sections 4, 5, and 6.

4. A PREDOMINANTLY RECEPTIVE DISORDER WITH TYPICAL CHANGES IN EXPRESSION: CASE NO. 31

No. 31. *A case of predominantly receptive disorder affecting both the understanding of spoken language and of printed material and accompanied by characteristic changes in expression. The patient was a very intelligent man, one of the most prominent attorneys in his state. The neurological symptoms were slight and resulted probably from a thrombosis of the peripheral cortical branches of the left middle cerebral artery, largely in the motor-temporal area.*

Male, white, 57; lawyer; high-school education; right handed.

Psychological Summary

The aphasia was predominantly receptive with characteristic changes in expression. When first examined, the patient spoke freely and at some length, but he often had to hesitate for names which he could not remember or for a new word or form of expression more clear than the one he had just used. His verbal and structural confusions were many, and were sometimes so extensive as to make the product incoherent. He was frequently aware that he was "not saying anything," but he allowed many confusions to pass without comment or hesitation. Although he could indicate the use of familiar objects, he had great difficulty in naming them. His written expression was more confused and incoherent than his speaking, and showed marked perseveration.

No. 31 could pick out common objects to oral command, but he failed to understand many of the very simplest spoken questions and directions. He read many single words aloud correctly but usually became confused in reading phrases or sentences; in these longer sections the earlier words often perseverated and one part of the response was sometimes contaminated by another. His understanding of printed material was superior to his understanding of spoken language.

In this early period the patient's performances on arithmetic computation tests ranked higher in relation to the normal than did any other performances involving language terms. His work on the language intelligence tests was very poor. His non-language performances were clearly superior to the language, and were often carried through well when the language responses accompanying them were badly confused. His levels on various performances are represented in Figure 25 (page 421) in terms of the variability of the normal group.

No. 31 was observed at intervals for twenty months after the attack. During this time he improved greatly. Within a year his expression in speech and writing was abnormal only in his occasional difficulties in maintaining the thread of the material and in evoking the correct words, and in the few verbal confusions and awkward constructions. His understanding of spoken language had become progressively more satisfactory so that he was able to follow an ordinary conversation. He had difficulty, however, whenever he attempted to carry on a conversation with several people, and whenever he attempted to grasp long or complex statements or statements having no natural relation to the particular situation. He continued to derive more satisfaction from reading than from listening to speech, but found a section as long as the ordinary paragraph "the devil." He could understand such a section only by going over it several times. His performances on arithmetic and language intelligence tests had improved so that some of them reached or excelled the medians of the normal group. They did not, however, reach the levels which would have been expected of the patient before the attack. Those language intelligence tests requiring constructive mental activity remained more difficult for him than those requiring the production of words in simple direct relations, or those requiring the definition of words or the recognition of word meanings. The patient had improved greatly in the immediate reproduction of verbal material but he had not reached normal levels, nor could he learn new verbal material with any facility or certainty.

No. 31 was extremely emotional during the months just after the attack, which was brought on by his wife's death, and some degree of emotional disturbance persisted over the whole period of observation. Many of his verbal confusions at first, while undoubtedly manifestations of the aphasic disorder, were of such a nature as to reflect the emotional disturbances.

For the first month after the attack No. 31 was very restless, getting up from his chair every few minutes to look for an illustration in a magazine or for a name he had written down. He would frequently stop to light a pipe or a cigarette and immediately let it go out. He was easily upset by examinations, and he required constant encouragement. When the work was interrupted by frequent periods of conversation and encouragement, he cooperated fairly well.

Neurological Summary

At the age of 55 and three years before he was first examined, the patient was said to have had a right hemiplegia from which he made a quick recovery. This history, however, is by no means clear, but he had been well and practicing up to six days before he was first observed, at which time his wife, to whom he had been much devoted, died. While under this great emotional strain, on attempting to telephone to his sister he found he could not make himself understood. This was the beginning of his aphasia. His emotionalism continued, he cried readily and complained of pain in the head and over the left side particularly. There was no weakness noticed anywhere, but it was said that he could not shave himself and that he did not use his knife and fork properly.

When examined six days after the onset he was very emotional and irritable and became angry because he could not make himself understood, and his face flushed readily. Neurological examination was negative, with the exception that he had a small amount of weakness in the lower right face and right palate. The reflexes on the right side were quicker than on the left but not much so. Sensation was normal. Ophthalmoscopic examination showed a moderate angiosclerosis.

During the almost two years that he was under observation his emotionalism continued. After a time it was difficult to find the weakness in the lower right face and palate. The reflexes became equally normal. An attempt was made to reeducate him but his emotionalism and irritability were such that it was found advisable to place him in a private sanitarium. At no time, however, did he show any mental symptoms. His condition was reactive to his situation.

About three years after the onset he died suddenly, probably from a cerebral hemorrhage.

The diagnosis was probably a thrombosis in some of the peripheral branches of the left middle cerebral artery. The lesion was probably in the motor-temporal area.

First Psychological Report

Speaking. During the first examination, from the second through the sixth week after the attack, *spontaneous speech* was broken and somewhat incoherent because of the patient's difficulty in evoking the essential words, his attempts to paraphrase in order to compensate for their lack, and because of his severe verbal and grammatical confusions. The following record was taken from one of his conversations two weeks after the attack:

> I just sat here last night by *himself* . . wrote these things that I told myself . . now they're things that I just *made* lying here in the night while I had no one *to live* . . didn't want anyone . . . she really wasn't fit for it . . . she ought to have been in bed several *months* . . several days . . (Gestured to indicate behavior of nurse who had a bad cold in her head.) . . like this all night . . . and I couldn't *stay awake* . . I couldn't sleep, *with all that thing to have her.*

Verbal confusions were sometimes more frequent than in the above quotation, and they were not always recognized and corrected as were "months" and "stay awake" here. A most unusual characteristic of the verbal confusions, which differentiated them from the errors of other patients, was the frequency with which some few words were used with many connotations. Objects, persons, or animals were often named "child" or "little child." These errors were especially interesting because the patient seemed to be unhappy about having had no children. The verbs "grow" and "drive" were used very frequently, and usually incorrectly. Some verbal confusions showed a clear sense relation to the correct word, like the use of "wet" for "bay" or "water"; others were substitutions of the more general class name for the specific word, like "lady" for "nurse" or "cubes" for "dice."

In addition to the verbal confusions there were frequent errors of the so-called literal type, for example, "hine" for "house," and occasional appearances of garbled words which seemed to have no relation to the correct word, as "chaik" for "shoe."

Grammatical confusions were sometimes severe enough to obscure the meaning. The last phrase quoted above, "with all that thing to have her," carries very little meaning. Errors in personal pronouns, such as the substitution of "himself" for "myself" above or the very frequent confusion of "he" and "she," were characteristic. So, too, was the type of construction found, for example, in these sentences: "Every thing was nervous to me"; "It came awfully badly for me that day." Forms of expression like these, together with the paraphrasing which resulted from the difficulties and errors in word-finding, made the conversation peculiarly indirect.

While spontaneous speech was disturbed by all the confusions described above, it was nevertheless plentiful and freely articulated. In an effort to explain his thought, the patient would try one form of expression after another, and would sometimes approach the correct form thus. The tempo of speech seemed to be accelerated, but the patient claimed that he had always talked very rapidly, and also that he had always tended to say too much. When, for instance, he had dictated a speech or a brief to his stenographer, he had always had to cut it down considerably in revision.

About a month after the attack, when his speech had become slightly clearer, the patient chose the correct use of a word or the correct grammatical form, in 85 cases of 100 (Stanford Achievement Language Usage Examination). For instance, in this sentence:

are
The news bad today,
is

he crossed out "are," saying "We use *is* in news, don't we?" His success on the test showed that he was far better able to select the correct verbal usages and the correct grammatical forms than to employ these in speaking or writing. His own errors, however, usually differed from the "experimental errors" of the

Language Usage Tests in that they involved a really absurd use of words and very gross grammatical confusions. He had obviously learned the correct usage of words, and he did not, in his deteriorated performance, fall back to an earlier developmental level; on the contrary he misused words as no normal person would, even at a very low stage of development. Similarly with regard to the grammatical confusions, No. 31 did not make errors which showed a lack of development. He did confuse some grammatical forms comparatively late in their normal development, and thus possibly more likely to show early deterioration; he confused pronouns, for instance, or the adjective and the adverb form; but, on the whole, his most serious grammatical confusions involved a gross change in sentence structure unlike any difficulty in the normal course of development.

Although names and appropriate phrases occasionally came more easily as direct products of a situation than as more voluntary responses, *reactive speech* was not much superior to spontaneous speech.

No. 31 could usually say *automatic word series* correctly, but at first he did not understand the nature of the problem until one or two words of the series had been pronounced for him.

Naming. Naming tests of all kinds showed the patient's difficulty in evoking names and his tendency to use the wrong names. When he failed he frequently described the use of the object, or indicated the use by precise gestures. He was more accurate in naming the colors of Head's Test than in naming the common objects. He could pick out objects or colors to oral or printed command. He did not always recognize a wrong name which he had given. He often suggested a garbled name similar in sound to the correct name, or a corrupted form of the correct name, and could not progress from these attempts to the correct word. A *knife,* for instance, was "That damn thing that gives me trouble all the time . . . for a *wife* . . . that'll fix up . . . ."; a *bed,* "a little place for a chile . . . for a *begy* chile." The corrupted words were sometimes the result of contamination from an earlier response. Occasionally an earlier response perseverated without change.

Repeating. No. 31 could usually repeat short words correctly, but not long words, series of words, or short sentences. Although words were occasionally misformed because of a sound which perseverated from an earlier response, his articulation was good. His difficulties in repeating depended largely on his inability to grasp spoken language except in very short sections.

Understanding spoken language. No. 31 could from the first pick out most objects and colors to oral command. He had great difficulty in understanding directions or questions which contained more than one word. He could not at first point to his nose, eyes, etc., accurately, although he sometimes understood the key word in these directions and then discussed the nose, the eye, etc., as the case might be. He could not understand such simple questions as "What must you do when you are cold?" (Stanford Binet, Year IV.) He improved sufficiently in the first month of observation so that he could respond to simple directions and questions, but he was still unable to respond to any which involved a twofold direction or two key words.

His very poor understanding of spoken language naturally made it difficult for him to grasp the necessary directions for many of the tests, but this difficulty could usually be overcome by repetition of the directions in sections and by supplementary gesture or demonstration.

Reading. No. 31 was from the first able to *read aloud* names of common objects and to choose from a group of such objects that one which corresponded to the printed name. He made occasional mistakes, however, in the opposite process, that is, in choosing that one of four printed words which corresponded to a given picture (Gates Word Recognition Test). His errors here indicated a confused verbal interpretation of the picture, as a result of which one of the incorrect printed words seemed to him a better representation of the picture than the correct one.

The patient usually read single words aloud correctly, but when he began to discuss them he sometimes pronounced them the second or third time in a corrupted form. When he read phrases or sentences aloud, he frequently mispronounced words. Some word or speech sound would occasionally perseverate or contaminate one of the succeeding words. Sometimes the patient was conscious of his errors and could even define them. He read, for instance, in one of his magazines, "Chippendale style, 1730 to 1780," and then "Heppenwhite . . Heppelwhite"; and said: "Well, that that *l* ought to be remembered there . . . I know them perfectly well." Usually, even when he recognized the errors, in defining them he added further confusions, often new words related to the words he was trying to correct by some sound similarity.

There was no regular relation between the accuracy of his reading and his *comprehension in reading*. Sometimes when he misread words in a sentence or confused the whole sentence, he was still able to show his understanding of the meaning of it by marking that one of four pictures which illustrated the sentence (Gates Word, Phrase, and Sentence Reading Test). In other cases he read correctly without grasping the meaning. In connection, for instance, with the sentence "One cloud may be seen close to the hill," he could not choose between the picture in which the cloud was *close* to the hill and the picture in which it was further away.

With more complex material, which was, however, still within the reach of the poorest literate normals, the patient's difficulty increased tremendously. His failure to understand was naturally more marked with the more complex material, but, in addition, he here misread and misunderstood many simple names which, separately, would not have confused him.

When reading what he had himself written the patient usually read faster, but with just as many errors as in other reading. These errors, together with the confusions of the writing itself, made the product quite incomprehensible.

The patient's greater speed here and his fewer hesitations probably depended upon the fact that he was aware of the general thread of the passage of his own writing and was in part telling the story again instead of reading it.

Writing. The patient's *spontaneous writing* was similar to his spontaneous speech, but even more confused. Cases of that indirect form of expression noted in speaking were frequent in writing too; for instance, "flowers looked over by us" for "flowers we looked at." The following record is a typical example of spontaneous writing:

> The small things I am trying for you I am paying little places I am doing for you and whatever from time to time I am doing little and am dying for you now or any time I can only remember that my Mother, my —— (Here the patient gave his wife's name.) are things at any time, now or otherwise for you, and there is little or practically little I am bringing for you.

The perseveration here is obvious.

Verbal errors were not so frequent in writing as in speaking, perhaps because in writing the patient had greater opportunity to paraphrase or to avoid words which failed him. He was, however, no better able to write names of objects than to say them. There were few misspelled words in writing, and no words which would parallel the misformed words of his speech.

No. 31 could write single, familiar words *to dictation* without errors in spelling, but became confused when long words or short phrases were dictated, even if these were repeated several times. His performance in writing to dictation was comparable to that in repeating.

He *copied* from print into script fairly rapidly and with very few errors, and these errors were for the most part corrected spontaneously.

Arithmetic. No. 31 fell among the lowest quarter of the normal group on printed *arithmetic computations* (Stanford Achievement Computation Test). Although he sometimes expressed it wrongly aloud, he understood the nature of the arithmetical process required for each computation whether it was represented by the arithmetical symbol or by the printed word. He tended to do the work aloud, and the spoken and written numbers often differed. He would say, for instance, "Three plus four is five," but write the number "7" correctly. Conversely he would sometimes say the correct number and write a wrong one. This type of error was to be related directly to the verbal confusions characteristic of his disorder. A second type, which accounted for almost all the remaining errors, was either in carrying or in adding the number to be carried on to the following column. In his effort to solve the partial addition or multiplication, he seemed to forget or confuse the number which should have been carried from the preceding partial sum or product; the twofold problem whenever carrying was involved was exceedingly difficult for him.

Although his performance in arithmetic computation was poor, he had relatively little difficulty with the techniques of the process. He did not hesitate over the mechanics of carrying numbers, although he often failed to add them on correctly. He handled fractions relatively well and could, for instance, multiply a compound number by a whole number without error in the part of the problem involving the fraction. It was clear that he had retained "arithmetical habits" even when his verbal confusions led to many errors in the actual number combinations, and when the increased difficulty of the process as a whole led to additional errors in the twofold problem involved in carrying.

No. 31, in spite of his fair success with arithmetic computations, could solve only one or two simple *arithmetic problems,* whether they were presented orally or in print (Stanford Achievement Arithmetic Reasoning Test). In either case he misunderstood the words, giving, for instance, the number of pennies in a dollar instead of the number of dimes, or else misunderstood the general import of the problem. His failure was not, of course, to be attributed to arithmetical factors, but to extensive language difficulty.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. At first No. 31 could not understand the problem of the *Opposites Test,* even when illustrations were given. In the *Sentence Completion Test,* he read many of the sentences correctly and supplied words in each blank, but he did less well than the poorest of the normal group.

REPRODUCTION OF VERBAL MATERIAL. The patient's difficulty in grasping verbal material was so great that he could not repeat four digits, three words, or sentences of as many as six syllables.

That he enjoyed looking through the daily papers for news about his friends and acquaintances, and that he several times added the middle initial when this had been omitted, or corrected the spelling of the name, showed he was able to reproduce some verbal material with accuracy. His later comments, however, showed that in these early weeks he had been confused about many things which he had formerly known. He could not, for instance, formulate the difference between William Penn and Benjamin Franklin, and he could not appreciate the difference in his own mind.

NON-LANGUAGE PERFORMANCES. The patient's non-language performances were clearly higher than his language. He reached the medians of the normal group in the quality of his performances in filling in *formboards* and he almost reached the medians in speed.

He was not quite up to the medians on speed tests of the *digit-symbol substitution* type. For him the substitutions were language performances: he described the nature or direction of the difficult symbols in verbal terms as he wrote the digit, saying for instance: "This made out that funny thing is seven"; or, "And one to turn over this way is three." It was, of course, an open question whether briefer and more direct phrases, such as the patient might have used naturally before the disorder, would have contributed to a more rapid performance.

In *reproducing designs* which had just been presented for a ten-second exposure, No. 31 did less well than the median of the normal group.

No. 31 equalled or excelled the normal medians in the *Picture* and *Drawing Completion Tests.* That he did well in filling in these incomplete pictures is the more remarkable because the verbal accompaniments of his responses were often extremely confused. While drawing the bow, for instance, for the picture of the man holding a violin, he said:

> This man needs his stove, needs his stuff. (Gestured to indicate how bow is drawn across strings.) That's very poorly good.

As a matter of fact his drawing was more exact than the majority of normal drawings.

In drawing a *picture of a man,* the patient's score of the Goodenough Scale was almost up to the median of the normal group. His drawing was fairly complete and accurate, although he misnamed many parts as he put them in, calling hands "children," fingers "men," and buttons "a house." The figure was schematic and very childish, but such drawings did appear among the normal adults.

Evidence of good spatial orientation, which was to be found in various nonlanguage tests, was also given by his understanding of maps.

Second Psychological Report

When the second study was begun six months later and seven months after the attack, there had been a marked and general improvement. The patient was more calm about matters relating to his wife or her death and, although naturally much concerned about his condition, he was more reserved in speaking about his personal affairs. He was less distractible and less easily disturbed by the examinations. His speech was more direct and contained few misused words; his writing was very much improved; and his understanding, both of spoken language and of printed material, was far greater.

During the five months since the first study, he had made a great effort to write down words which caused him trouble, to look them up in the dictionary, and to read and find the meaning of newspaper reports and short stories from magazines. Furthermore, he had learned to write with his left hand, and although he complained of great inconvenience he used this hand in all his writing. A certain amount of training was carried through during the five months of this second period of study. The patient worked for two or three hours each week with the examiner, and for additional hours by himself. The training centered on the correct use of words and satisfactory sentence structure, and on the comprehension of the essential point of oral and printed passages. The principal exercises fell into two groups. Those of the first group consisted of review of the most common words in the language (Thorndike, *Teacher's Word Book*), by connecting these words to the objects, actions, or attributes they represented, by defining them, and by using them in spoken and written sentences; and also more complicated sentence constructions based on the use of two or three given words in one sentence. The exercises of the second group consisted of relatively short oral passages and longer printed passages to which the patient had to respond either by appropriate action or answer or by giving an abstract of the passage.

The second period of study terminated abruptly at the anniversary of his wife's death, when the patient again became very much disturbed. Although no tests could be repeated to determine the extent of the improvement which had taken place during the five months, the weekly records showed improvement both in expression and in understanding. The patient had less difficulty in producing the correct words; he was much more accurate in sentence structure and more certain of his performance here; and he understood spoken language and printed material more readily.

The findings of the second examination were as follows:

Speaking. The patient's *spontaneous speech* no longer showed gross structural errors, but slighter errors were still frequent, and the speech as a whole was broken as in the following passage because of difficulty in finding the correct word.

> Did I tell you I was going to see George Arliss? I got the story but I couldn't tell you anything about . . . I'll get any picture as I told you before, I get those, just the very few that I have *taken* . . . but I do it if they were French or German or Dutch or any other. But it is just the picture. But as the words I'd get some of them, oh, I get a good many of them.

The patient very rarely misused words, but he still had great difficulty in evoking the correct word. He had spontaneously developed systems for remembering particular words. Two of these he described as follows:

> *Table* . . . I have to get that word by Aesop's Fable and then I get *table.*
> I couldn't say *granite* and I'd think of Ulysses Grant . . . Captain and General Grant and . . . General and President Grant . . . and I'd get that word *granite.*

It was also clear that he could sometimes produce names when he described the object, or when he drew it. Once when he could not name a foot-rule, the word came to him after he had drawn a picture and sketched in the twelve inch spaces.

He still misformed words occasionally, but not so frequently as before. In one or two cases he reversed letters or syllables, saying, for instance, "mobride" for "bromide." In some cases he ran parts of two words together, omitting the remaining parts, as in "I fouldn't" for "I found I couldn't." These errors were always more frequent when the patient was fatigued or emotionally disturbed.

There were still some specific grammatical errors: occasional confusions of personal pronouns and other errors which had perhaps earlier been covered by the more extensive changes. No. 31 sometimes complained that he was confused by the various parts of an irregular verb. One or two of these were explained to him; others he worked out for himself, for instance:

> There are three words, same thing—*freeze, froze, frozen.* You know I had the dickens of a time to get that: it was *frozen* last night, the ice *froze* today, and you will *freeze.*

UNDERSTANDING SPOKEN LANGUAGE. No. 31 had made clear progress in understanding both spoken language and reading. He now had no difficulty with simple oral directions or questions, unless some earlier confusion persisted in his mind and so disturbed his approach to the new problem. He was still confused whenever the questions were complex or whenever he had to speak with more than one person at once.

He showed steady improvement during these five months of observation in responding by an answer or a brief abstract to the practice sentences which were read to him. Whereas at first he could usually give only one or two separate words, later he was often able to give the general meaning of the sentence or its essential point.

READING. In *oral reading,* No. 31 now made few errors. His usual slowness depended largely on the difficulty he was experiencing in understanding the passage.

In *silent reading,* he was clearly retarded, and he fell below the median of the normal group in the extent of his comprehension (Chapman Cook Speed of Reading Test and Chapman Unspeeded Reading-Comprehension Test). Thus while he had improved greatly during the seven months since the attack, he was still far below his own level.

During the next few months he noticed that he could grasp the essential point of articles and stories with greater ease and fewer repetitions, and his observations were confirmed by his reports on the material he read during the training periods.

WRITING. Immediately after the attack *spontaneous writing* had been even more seriously disturbed than spontaneous speech. The two were now closely comparable. The great improvement in writing may be illustrated by the following passage, a typical performance at this time:

> I saw *Moby Dick* tonight. I read a very small part of the book, possibly two or three years ago. I understood all of the movie without any trouble, and could get a *fairly part* of the words, but not all by any means.

The sentence construction was good. The one error, a *fairly part,* was typical of the patient's grammatical errors in writing at this time. These small, specific errors were to be contrasted with the extensive structural confusions of the earlier writing. When questioned about this error, the patient was unable to correct it. He was asked if he meant "a fairly large part," and said: "No . . . fairly part . . . not 'it was a large number' or 'very much,' but *fairly* is simply *average* part." When the mistake was corrected and the respective uses of the adjective and adverb illustrated, he accepted the correction readily.

The practice exercises in writing sentences containing given words usually showed more errors than the spontaneous writing. Their relative difficulty was a natural result of the requirement that a specific word be used and of the artificiality of the test situation. These practice sentences became more accurate and more complex during the five months of study. At first the use of *one* given word in a sentence made the task difficult enough, and although many responses were correct, confusions or errors, such as those illustrated by the following examples, were frequent:

> To use the word *condition:* In the condition referring to my mental condition is bad.
> To use the word *duty:* My duty should be tried by me.

After three months the patient was able to use three given words in a sentence and to write complex sentences with very few errors or awkward constructions. The following example is typical.

> To use the words *report, unemployment, money:* The —— County President of the Red Cross told the report to the press there was little money and a tremendous amount of unemployment.

Arithmetic. No. 31 could now do *arithmetic computations* with greater accuracy than before. His score was equal to the median of the normal group, but he would undoubtedly have reached a higher level before the attack (Stanford Achievement Computation Test). He worked more rapidly than before, and with less oral calculation. Consequently his work could not be studied so closely. Apparently, however, he did not misname numbers as he had before. He frequently complained that his only success came through rapid work, that: "If I do it slowly and figure the thing exactly, I'm not sure whether I get it right or not." He also complained that he could do multiplication only by adding; but the problems he solved aloud contradicted this statement, and separate tests showed that his work in multiplication and division was at least as good as in addition (Woody Arithmetic Scales).

No. 31 now read and solved simple *arithmetic problems* rapidly and fairly accurately (Stanford Achievement Reasoning Test). Even occasional misreadings did not lead to errors in his answers. This improvement in the seven months since the attack undoubtedly depended on greater facility of language, and especially on greater facility in reading. Even now, however, he did not quite reach the median of the normal group.

Performances on language intelligence tests. Whereas one month after the attack, No. 31 had no success on the *Opposites Test,* seven months afterwards he gave as many correct responses as the median of the normal group, although he was slightly below the normal median in speed. Even then he was probably below his original level, for he had been a very intelligent man.

On the *Sentence Completion Test* he was still very poor, falling in the lowest quarter of the normal group. The test obviously required a performance more difficult for him than that of the Opposites Test. Instead of giving one response word, determined by the particular relation of *opposite,* he had to construct a coherent sentence on the basis of the given fragments, taking care that the words he added were suitable in meaning and correct in their grammatical forms. Sometimes he failed to get the meaning of a sentence; in other cases he apparently appreciated the general meaning, although he ended by destroying it through the substitution of words unsuited to the content or the structure of the sentence.

In *vocabulary,* No. 31 was well above the normal medians, both in the oral definition of words and in the selection of synonymous words in print (Stanford Binet Vocabulary Test and Thorndike Test of Word Knowledge). He was almost up to the level expected of a man of his intelligence and training. The contrast between the vocabulary tests and the tests of more creative language intelligence, such as the Sentence Completion, was very marked for this patient, as for many other aphasic patients with various types of language disorder.

Reproduction of verbal material. With improvement in his grasp of verbal material, No. 31 was better able to reproduce series of digits, words, or sentences immediately after their presentation. He could repeat seven digits, but did less well with word sequences, or with sentences, probably because of the greater variety characteristic of these.

Various learning experiments with verbal and non-verbal material were attempted, but were particularly distressing to the patient. He was asked, for instance, to learn the first sentence of Lincoln's Gettysburg Address, and was willing enough to do so. After a few days, however, he reported that he had been unable to learn it.

> About four score and seven years is all I get straight. Then I get your continent and your nation and your dedication. Here was the way that helped me.

The patient then showed a paper on which he had written the phrases line by line:

> Four score and seven years ago
> our fathers
> brought forth
> on this continent, etc.

These divisions did not help him to learn the whole, although they perhaps contributed to his learning of some of the key words. He could never reproduce the whole verbal formulation, nor yet give the general idea of the sentence.

As this attempt at learning would indicate, he had greater success when the material consisted of a series of distinct names or terms. After looking for an hour or so at sixteen names of departments of knowledge and art which were carved in stone around a library building, and writing these down in his notebook, he was later able to reproduce them several times during the day. In order to remember some of them he developed special methods like those he used in recalling names which were hard for him. *Sculpture,* for instance, was "just the skull." Such methods were really useful aids in recalling separate names, but they were of little avail in recalling connected material.

Third Psychological Report

No. 31 was examined once again nine months later, twenty months after the attack. The emotional disturbance seemed now to be more severe, but the patient was willing to cooperate on the tests. Although his performances were much the same as they had been nine months before, there was slight improvement on the language intelligence tests.

The significant points of this examination were as follows:

The patient still hesitated for words in *spontaneous speech,* and occasionally used awkward grammatical constructions.

He still had difficulty in *understanding spoken language,* particularly if talking with more than one person.

In *oral reading* he made very few errors, but again was below the median of the normal group in rate. In *silent reading* he understood the material about as well as before, although he complained that "the paragraph is the devil to me." He had found that phrases such as "not impossible" were particularly difficult for him. This one he was now able to understand: "I just say it's possible, and then I get it."

On the *Sentence Completion Test* his score was slightly higher than before, but still within the lowest quarter of the normal group. The improvement seemed to result from better understanding of the sentences, even though he could not always produce the correct words to fill the blanks. In the sentence, "Children — to pick —," he supplied "have" and "strawberries," but he was dissatisfied with the result and said:

> Children have to pick strawberries; this isn't right. (What?) Children *have* to pick strawberries. They don't have to, but I can't get it.

In such instances he seemed to have a better understanding of the general significance than he was able to demonstrate by the selection of suitable words.

5. A PREDOMINANTLY RECEPTIVE DISORDER WITH MARKED DIFFICULTY IN READING AND TYPICAL EXPRESSIVE CHANGES: CASE NO. 22

No. 31 and No. 22 are interesting cases individually, and together they illustrate almost all the disturbances which may characterize a predominantly receptive disorder. No. 31 experienced a serious difficulty in the understanding of spoken language, No. 22 a complex and severe difficulty in reading. Both showed similar disturbances in expression, but in the case of No. 31 these were far more serious at first but of shorter duration than those of No. 22. Both showed non-language performances which were generally higher than the language.

No. 22. *A case of predominantly receptive disorder with marked difficulty in reading and characteristic changes in expression and in naming. The neurological symptoms were slight. The lesion was probably a cortical hemorrhage in the left central and temporal convolutions.*

Male, white, 50; manager insurance office; equivalent of high-school education in private college-preparatory school; right handed.

Psychological Summary

The aphasia was predominantly receptive, with little difficulty in the understanding of spoken language but extreme difficulty in all reading processes. The expressive disturbances were characteristic: speech and writing were free and plentiful, but disturbed by a number of verbal confusions and by indirect or defective grammatical constructions. Misformed words were rare in speaking but more frequent in writing. In writing, too, the sentence structure was occasionally defective because of the omission of a word. Although speech and writing both lacked normal continuity and coherence, neither was held up very much by the patient's difficulty in evoking the suitable word. This difficulty was serious and it appeared clearly on the naming tests, but the patient compensated for it in speaking or writing by rapid readjustment of the sentence and by the introduction of round-about expressions.

The patient's great difficulty in reading involved the mechanics of the process as well as the higher functions of comprehension. His perception and recognition of letter forms were faulty; he usually read words best when he "brought out" the letters one by one but even then his performance was not certain. A good deal of his difficulty in understanding printed material naturally depended on these defects, but there was no regular relation between the quality of his "mechanical" reading and the extent of his comprehension.

The severity of the reading disturbances was striking in contrast to his relatively good performances in writing to dictation, in arithmetic, and in response to non-language tests. Figure 10 (page 239) shows his scores expressed in terms of the variability of the normal group, with the various indices for reading very low and those for writing and spelling and most of the non-language work high. The scores for language intelligence tests are relatively low, partly because of his language confusions. Some of his non-language performances reached or surpassed the upper quartiles of the normal group and were superior to any of his language performances. They were often correct or adequate in spite of confusion in the verbal responses accompanying them. Others, however, were obviously below the levels which would have been expected of the patient normally.

No. 22 made a gradual, slight improvement during the first four months of study. The extent of his progress is represented in Figure 10 by the difference between the black dots and solid line, indicating the scores on the first tests, and the crosses and broken line, indicating the scores on the second. It will be evident that improvement occurred in reading, writing and spelling, arithmetic, and performances on language intelligence tests. There was also clear improvement in speaking and naming, which cannot be represented on the graph. Progress was less general in the non-language work, but most of the scores were higher on the second examination than on the first.

At the end of four months the patient had an attack of unconsciousness, after which a definite regression was apparent. The tests which were given at this period yielded results almost identical with those of the first examination. The striking similarity will be evident from Figure 10 where the rings representing scores on the third tests fall close to the dots representing scores on the first. The net result of the attack at this time was to wipe out the progress which the patient had made. After the attack spontaneous speech was more confused and naming tests were less well done. Understanding of spoken language was still fairly satisfactory, but reading was about as difficult as it was in the beginning, and the old confusions between "b" and "d" were again frequent. Performances in writing spontaneously and in copying also showed the deterioration. There was again some improvement, however, during the last month of study.

The patient always cooperated well and worked steadily. He sometimes protested that the examinations had no relation to his work in the insurance office, and that the examiner would fail on such work just as he failed on the

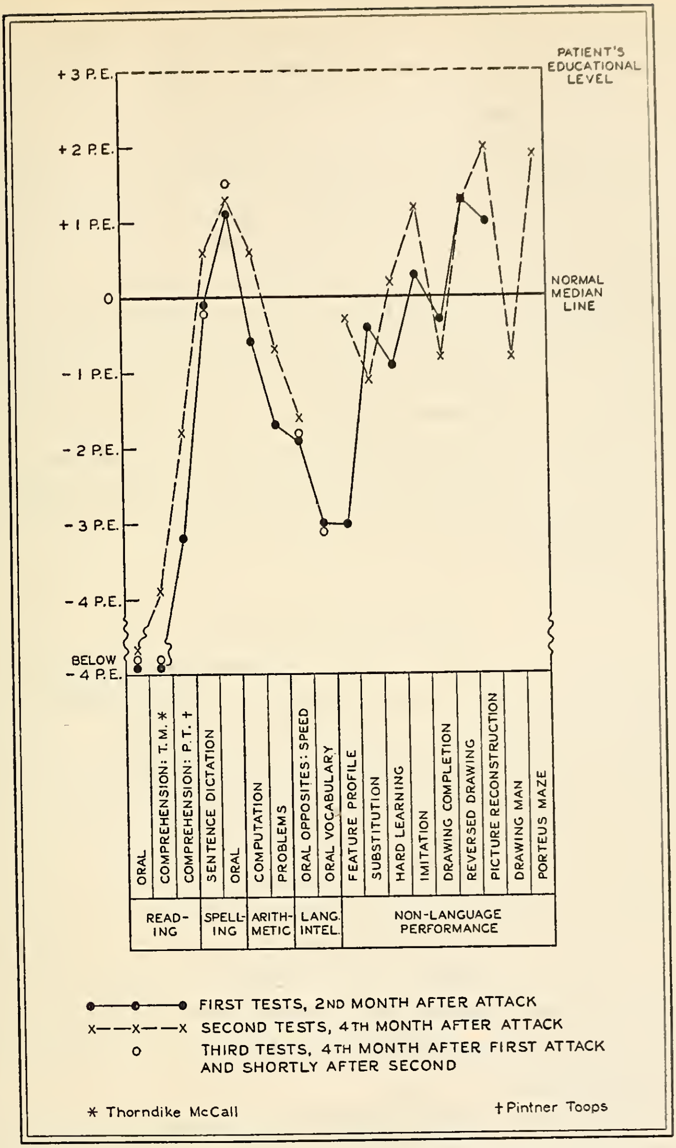


Figure 10. Successive performance levels: Case No. 22, receptive

examinations. His comments showed a good deal of insight; for instance: "If this place got on fire and I came to you, I'd get you so you wouldn't know what you were talking about." He recognized his chief difficulties, in naming and reading, but he had no real appreciation of their extent.

As to his social reactions, his behavior showed that he enjoyed some of the people in the hospital and disliked others who suddenly asked him questions he could not answer or disturbed him in other ways. He could imitate some of the people who annoyed him so that they were easily recognizable. Whenever verbal expression was an important factor, however, as in his letters about his home, his responses were less natural. They lacked the insight which his reactions to practical and concrete problems generally showed. Similarly, while he understood and enjoyed amusing situations in moving pictures, he was never amused by any absurd statements of the tests or by any of the funny situations which arose in the testing. Thus his language disorders apparently had an appreciable effect on his social perceptions and relations.

Neurological Summary

This patient, who had had a responsible position as manager of an insurance office, without previous medical history, suddenly fell and became unconscious. A diagnosis of uremic coma was made. He remained semiconscious for a week and on regaining consciousness no motor or sensory symptoms were found but he had an aphasia. His blood pressure was quite marked, being 240/120.

On admission to the Orthopedic Hospital about six weeks after the attack, his blood pressure was still elevated, being 220/120. The only neurological symptoms consisted of slight weakness in the lower right face, and the reflexes, which were prompt on both sides, were slightly more so on the right. Repeated examination showed no disturbance of sensation and no alteration of visual fields, although ophthalmoscopic examination showed marked angiosclerosis.

The motor symptoms gradually lessened in the course of the five months that he was under observation in the hospital, and when he was discharged he had only a slight weakness of the lower right face, which would not have been noticed had it not been for his previous history.

Further examination showed a moderate chronic kidney condition but blood chemistry was within normal limits. Spinal fluid pressure and reactions were normal. His blood pressure moderated a little but about six months after the onset he suddenly developed a brief unconscious attack, the blood pressure rising to 260/130. The attack, witnessed by a nurse, was described as follows: "While sitting in a chair fell to the floor; there was tremor of the entire body; the muscles were rigid, the face red; he frothed at the mouth, but did not bite the tongue and there was no incontinence. The attack lasted ten minutes and was followed by profuse perspiration and headache. The pulse was good." While the neurological symptoms did not increase, his aphasia became distinctly worse. During the rest of the period in the hospital his hypertension was high. Two weeks following his discharge he suddenly died, probably from a cerebral hemorrhage.

This case is very interesting in view of the fact that the aphasia was marked and yet the neurological symptoms consisted only in a hypertension, slight weakness of the lower right face, and increase of reflexes on this side. Following the unconscious attack which he had in the hospital it was interesting to note that while there were no new neurological symptoms yet the aphasia was much more severe, i.e., almost as in the beginning of the study. It is probable that he had an extension of his lesion comparable to that existing in the beginning.

The pathology was uncertain. He may have had slight hemorrhages in the left brain resulting from the cerebral arteriosclerosis, the unconscious period resulting from his uremia. The lesion was centered in the neighborhood of the motor area as indicated by the increase of reflexes on the right and lower facial palsy, but there was no definite indication as to the seat of the lesion which led to his aphasia.

Psychological Report

Speaking. Immediately after the attack the patient's speech was reported to have been almost unintelligible because of his many verbal confusions. When he was examined seven weeks later, although his *spontaneous speech* was broken by hesitations for words and disturbed by paraphrasing and by verbal and grammatical confusions, his meaning was always clear. Typical speech of this time may be illustrated by the following record:

> Do you find any difference in me from last week? Don't you think I need a little mustard . . . something of that sort . . . medicine? I am better but I can just get caught by little . . . Only two things with me that are the matter . . those questions you asked me (To name objects.) and then this little matter with the eye . . . My eyes are not so large as they used to be

> and they are a little larger than they were. It's getting better all the time and my health feels very well.

Examples of the characteristic speech errors appeared in this passage: the misuse of words, "mustard" for "medicine"; disturbances in word order, "only two things with me that are the matter"; and awkward constructions, "my health feels very well." More severe grammatical confusions, like those found in writing, did not appear in speaking.

The patient's verbal confusions were generally related to the correct word in meaning or confined to the "sphere" of the correct word. Confusions of the second type were more marked in this case than in any other case examined. No. 22, for instance, spoke of "two sets of teeth" when he meant "two pair of glasses," and of "loud print" for "large print." He rarely referred to his physician correctly as "doctor," but used names from other professional fields, saying, for instance, "the lawyer," "the judge," or "the pastor over on twentieth street." The substitutes for "doctor" were excellent illustrations of "sphere consciousness" because, although a variety of names were used, they were limited to professional fields. Related to these verbal confusions within the sphere of the correct name were the substitutions of a more general term for a specific name. No. 22 did not use the word "nurses" but spoke of "the ladies" or "the members here."

Another interesting characteristic of his speaking was the paraphrasing which he attempted when he could not produce the necessary word. This round-about expression was especially evident in the naming tests.

Incorrectly formed words, which would be comparable to some of the letter errors and misspellings of writing, were very rare in speaking. They appeared only when the patient was disturbed or excited, and they were usually corrected spontaneously. Once when he had just had a tooth extracted, and felt "a little nervous," he complained that he could not write well in the hospital, because:

> I've never been able to get pink here . . . er . . . ink here . . . and sometimes I've written smords . . . words to you, and you'll see that the ink's bad.

No. 22 gave *automatic word series,* the days, the months, and the alphabet, correctly. He was able to count forwards and backwards without error or hesitation. He made no errors in writing numbers; but he sometimes made a mistake in writing the letters of the alphabet, usually in writing "q," and he sometimes reversed a letter or a letter sequence in placing a series of block letters in alphabetical order.

NAMING. Naming tests demonstrated one of the patient's greatest disturbances. Although he could usually select the objects of Head's Test at oral or printed command, he failed to produce the correct name himself in more than half the trials. He was no more successful in writing the name than in pronouncing it. Several points were clear from the responses. First, when he gave a wrong name, it was usually the name of one of the other objects of the test. Thus the "sphere consciousness" which was evident from so many of his confusions of spontaneous speech, was not so potent a factor here as the group of test objects. His choice of names, however, was not always limited by the objects before him. In some cases, through his attempt to reach the name, he gave a complex response such as the following:

> (Scissors) That's a funny thing, we used to call it the opener in the office . . . the thing that opens critical articles . . . the opening citizen . . . we had a name something like that for it . . . scissors, I think it is.

Second, when No. 22 was unable to give a name, he often expressed the use of the object in some intelligible fashion, either by verbal formulation or by gesture. Thirdly, he sometimes reached the correct name indirectly, either by his expression of the use of the object or by sensory aids which he received in manipulating the object. Thus he would sometimes be able to say "scissors" after he had wriggled two fingers back and forth as if in cutting. Or again, he would hesitate over "pencil," reach toward his vest pocket where he kept a pencil, and then be able to say the name. His verbal expression of the use of the object, however, at times confused rather than aided him. Once, for instance, when he could not say "scissors," he explained: "Cut things with it . . . strings and things like that," and then gave the name as "stringer."

When the Object Naming Test was repeated after a week, the proportion of correct responses was higher; the errors were the same in character. After two months, there were again more correct responses, but this time the "pencil" was always called "pen," and the "matches" were usually misnamed. No. 22 still hesitated over these two objects when the test was repeated after another two months' interval.

The patient's performance in naming line drawings was similar to that in naming objects.

During the first week of observation, when the patient had had so much difficulty in naming objects, he had named colors relatively well. His performance was abnormal, however, in that he hesitated for the name and then rarely gave the simple name of the color. He would say, "It's bluish," or "Little on the green." Such responses would probably be normal for mixed colors of doubtful hues, but for relatively pure colors which were distinct one from the other they indicated an inadequate color appreciation. Furthermore, No. 22 frequently confused those colors which were most closely related, the yellow and the orange, the purple and the blue. Two months later some of these confusions were still to be found, but he named the colors directly. Interestingly enough, after the second attack he again named the colors indirectly as he had at first.

Repeating. No. 22 repeated numbers, words, and sentences accurately and without errors in articulation.

Understanding spoken language. No. 22 understood ordinary conversation well, and was successful with fairly complex questions and directions. His errors depended largely on the occasional confusion of the name of one object with that of another. On the whole his understanding of spoken language was less disturbed than any other language process. Frequent or persistent failures appeared only in connection with such statements as those of the Absurdities Test where an understanding of the words in the narrow sense was not sufficient, and there had to be some further intelligent development of the significance of the whole statement.

During the early part of the study No. 22 had difficulty in following directions involving spatial adjustments. His failures seemed to depend on confusions in the terms "left," "right," "lower," "upper," etc. (Kuhlmann Comprehension Test, Year VIII). When the test was repeated a month later, he responded correctly. He was also able to follow almost all the complex directions of the Abelson Geometrical Figures Test, which required not only the comprehension of the terms "circle," "square," and "triangle," but the retention and integration of long, complicated directions.

No. 22 did well with Auditory Discrimination Tests of the Gates Diagnostic Reading Battery. When speech sounds were pronounced for him, he could always name or come very close to the letters which stood for these sounds. When "nonsense" words of one or two syllables were pronounced, he made very few errors in spelling these as they would be written.

No. 22 was poor in discriminating melodies, but he said that he had never understood music; he had gone to many concerts because his wife enjoyed them, but he had never been able to tell the difference between the things played "unless they were funny."

Reading. The patient's reading was severely disturbed, both in relation to the normal reading process for persons of his intellectual and educational level and in relation to his own performances in other fields (Figure 10). He had difficulty in identifying letters, in pronouncing and in understanding words, and in the more complex processes of sentence or paragraph reading.

In *reading letters* he made many mistakes, more frequently with lower-case letters than with capitals. Confusions in a number of readings of lower-case letters in random order (pied text), appeared with every letter except "o." Mistakes in identifying letters in words and phrases, recorded whenever he spelled out words in reading, affected every letter of the alphabet. There was practically no relation between the order of the letters according to the frequency of his errors on them in reading pied text and the order of the letters according to the frequency of his errors in reading sense material (correlation of .07 by Rank Difference Method).

Analyses of the errors showed that letters similar in form, as "b," "h" and "k," or "f" and "r," were frequently confused, both in pied text and in word reading (see Table XI, page 245). Right-left reversals were numerous, particularly in pied text; the pair "b" and "d" were always more confusing to the

TABLE XI

PERCENTAGES OF LETTER ERRORS OF DIFFERENT TYPES: CASE NO. 22

	WHEN READING PIED TEXT	WHEN SPELLING WORDS IN READING
Letters most frequently confused		
z read as *x*	10	0
d read as *b*	8	4
b read as *d*	5	0
n read as *r*	0	4
Wrong letters most frequently suggested		
x	18	3
p	7	10
b	9	6
r	4	8
Types of confusion		
Form similarity	26	21
Sound similarity	9	11
Form similarity, if one of the two letters reversed, left-right	17	7
Form similarity, if letter and its reversed form superposed (as *c* and *o*, *z* and *x*)	14	4
Form similarity, if one of the two letters reversed, up-down	2	9
Unclassified	32	48
Confusions within one place of correct letter in alphabetical series	9	6
Confusions within two places of correct letter	38*	13

* Largely *d* for *b* and *x* for *z*.

patient than "p" and "q." He was conscious of his difficulty with pairs of reversible letters, and he would explain, as often wrongly as not, that: " 'd' would be that way; 'b' comes along and we do it just the opposite."

If all types of reversals were grouped together, they would outnumber the confusions which seemed to depend upon similarity of the letter forms in their natural direction. The figures showed, however, that there was no single basis for the confusions. Furthermore, large percentages of the errors could not be accounted for. A few of the "Unclassified" errors recorded in Table XI depended on the specific context, on the letters immediately preceding or on the word in question, but the majority of them had no observable basis.

In view of the complex and extensive letter confusions, a number of *perception tests* were used to study the patient's difficulty. That he recognized letters slowly was obvious from his poor scores on tests of cancelling out each "a" in a pied text.[1] He did less well than the poorest of the literate normals on the first trial, and only slightly better on a second trial two months later.

The Visual Perception Tests of the Gates Diagnostic Reading Battery were particularly important in this case because they provided for a comparison of performances in the perception of figures, of digits, and of letters and words. The first three of the five tests required, respectively, the marking of each pair of figures, digit sequences, or words in which the one part of the pair differed from the other. The pace in each test had to be rapid for only a limited time was allowed. In checking over the page of sixty pairs of figures, No. 22 made only one error. Clearly he was well able to preceive the slight differences, but he was not quite fast enough to reach the median of the normal group. In marking the digit sequences, he was lower, among the poorest of the normal group; and in marking the words, he was below the poorest of the normal group. Thus he did best in differentiating the figures, which did not directly involve language, less well in differentiating number symbols, and extremely poorly with letters and words.

The last two of the five tests required the perception of that one of five figures which was like a given figure, and of that one of ten or more word-forms like a given word. These two tests again showed that the patient was more nearly normal in finding the like figures than in finding the like words. With the figures, he worked slowly and fell considerably below the median of the normal group, but with the words, he fell far below the poorest of the normal group.

On the whole his difficulties in these tests were shown through his retardation; his errors were few. An analysis of the errors caused by his failure to differentiate between two words unlike in one letter or in the order of two letters, showed the same basis for confusion as had appeared from his errors in reading letters: reversible letter forms, similarity in letter forms and similarity in sound.

---

[1] Following Bouman and Grünbaum's experiment, a comparative study was made of cancelling letters in connected meaningful text and in pied text composed of the same letters. (Bouman and Grünbaum, *op. cit.*, 494–497.) The patient crossed a few more letters in a given time in the meaningful material, but he skipped more letters here than in the pied text. In relation to the few "normal" performances studied, No. 22 had greater success in crossing letters in meaningful material than in pied text. In any case, he was not hindered by any difficulty in picking out the individual letters of the word-structure as was the patient reported by Bouman and Grünbaum. In fact, No. 22 said he found the meaningful text easier because he knew where to look for the letters. He was, of course, considerably below the normal controls in his rate of crossing letters in either text.

The most frequent errors were the reversals, "d" for "b" and vice versa, and "w" for "m."

The results of a second examination on the Perception Tests showed a slight improvement in all types of response, but the same superiority of the perception of figures in relation to the perception of words or even of number sequences.

In connection with the studies of letter recognition, it must be noted that No. 22 made some mistakes in reading numbers, and was particularly likely to confuse "6" and "9," but never so many mistakes as in reading letters. He named most punctuation marks correctly, and all the arithmetical symbols; he understood the significance of the latter.

The first *reading tests* showed that the patient was aware of his difficulty and of some of its characteristics. He complained that letters and words "ran together," and to illustrate this condition wrote one word and then wrote another almost on top of it. Later on in reading he noticed that the letters were drawing apart and were clearer to him. Especially interesting was his recognition of the fact that while he could not differentiate letters clearly, he could see many things which were even smaller. One day when talking about his difficulty with letters, he held out a glove with lines of small stitches on the back of the hand, and said:

> Now, I want to tell you something. I can see these stitches on this cuff; they don't run together. Why not?

No. 22 had also noticed that he often spelled out words he could not understand and that he was sometimes aided by this method. Once when he hesitated over the word "children," he explained:

> Now a word like this . . . I can't get it unless I go over each one and bring it out.

Oral reading was extremely retarded because of the patient's difficulty in letter and word recognition and because of his attempts to spell words he had failed to pronounce or pronounced wrongly. There was little difference between the quality of his performance in reading single words and in reading sentence and paragraph material. Both showed certain irregularities. He would confuse simple words and then pronounce a more difficult word correctly; similarly after reading a few sentences very badly, he would sometimes read one equally difficult without error. A short section of perfect reading appeared when he read the following paragraph:

> The Eskimo builds his house of ice and
> snow. First he places blocks of ice in a circle on
> the snow-covered ground. Each row becomes
> smaller until the top is closed, making the roof.
> The snow is then shoveled over it until no
> cracks remain in the solid wall.

The patient's first reading of this section was as follows:

> The Eskimo *bought* his *r* o u s e . . . *rouse* of ice and s n o *h* . . . First he places blocks of ice in a circle on the snow-covered ground. *B* a c h . . *beach rock* . . . . b e c o m e *r* . . . . *become*
> *small under the first* . . . . *under* the *map* . . if c *r* o *l* e d, making the roof. The snow *if* then s *n* o v e *double l e even if* . . . u n f e l . . . . *untel* no c r a c *h* s . . . . *craches n e u* m a i n . . . *nemain* in the *sofel wail* . . . do you call it "wall"?

The above paragraph from a Gray Reading Test was the center one of three paragraphs which the patient was reading in succession. The perfect sentence, therefore, came relatively late when he might have been expected to be tired and confused; but there was no evidence, at least within the limits of 150 words, that the errors increased toward the end.

Together with this irregularity within a single trial, there was a constant and gradual improvement until the time of the attack of unconsciousness when the trials were considered as wholes. After this attack, there were again poorer performances (see Table XII, page 249).

As illustrated by the record above, some of the errors in oral reading were difficult to analyze. The majority, like many of the letter errors, depended on form similarity, as "even" for "over," "strong" for "strange," or "the smell is terrifying" for "the small interesting." Other confusions, such as "wort" for "word," more likely occurred because of sound similarity. Some mistakes were simply in pronunciation.

This patient, however, made an unusual number of errors either directly dependent upon the reversal of one or more letters, or indicative of a confusion in direction or order of the letters. The clear reversals consisted of such errors as the following:

botted for *dotted*
cowpanies for *companies*
net for *ten*

Among the more complex errors where there were evidences of reversal were:

back for *dark*
perch for *bench*
away for *many*
Mathas for *Thomas*
menspaper for *newspaper*

Because of the large percentage of reversals, No. 22 was asked to read the Gray Paragraphs as they were reflected in a mirror (see Table XII). His scores in time and errors for this mirror reading, contrasted with the results of his first straight reading of the paragraphs, indicated that mirror reading was not so much more difficult for him, in comparison to straight reading, as for the normal person. Like the normal reader, he often confused two letters when the mirror image of one was similar to the ordinary form of the other, as, for instance: the mirror image of "a" and the ordinary "s." Similarly in one-third of the cases he read the mirror image of the letter "b" which looked like "d," as a "d," or mirror image of the letter "d" as a "b"; but in two-thirds of the cases he read these letters "b" and "d" not as they looked in their mirror images, but in their reversed form. Thus in two-thirds of the cases he corrected for the reversal dependent upon the mirrored image. His tendency to reverse the letters "b" and "d" in straight reading was an advantage to him in mirror reading when reversals were necessary to correct the mirrored images. On the whole, his comparatively few errors in mirror reading confirmed the findings of the straight reading tests, and indicated that he had not the same rigidity or consistency in his appreciation of the direction of letters or letter sequences as the normal person has usually acquired.

TABLE XII

SCORES ON GRAY ORAL READING TESTS: CASE NO. 22

(Sets increase in difficulty from I through IV)

WEEKS AFTER FIRST ATTACK	SET I (50 words)		SET II (150 words)		SET III (150 words)		SET IV (150 words)	
	Time	*Errors*	*Time*	*Errors*	*Time*	*Errors*	*Time*	*Errors*
8			273″	52	510″	69		
13	60″	4	255″	23				
14					360″	40		
15							485″	32
17			175″	13	285″	11		
*	*	*	*	*	*	*	*	*
25			205″	34	430″	53		
26	45″	4					520″	35
29					347″	29		
READING RECORDS FOR PRINT REFLECTED IN MIRROR								
17	145″	8						
18	140″	6	549″	20				

NOTE: Asterisks indicate the occurrence of a second attack.

The patient's reading difficulty and the errors described above—those dependent upon similarity in letter- or word-form and upon reversals in letters or letter sequences—indicated the need for studies of reading with short exposure times. Preliminary tachistoscopic studies were made with clear quarter-inch lower-case letters, exposed for about one second through an adjustable opening in a cardboard frame, at a distance of 15 inches. (It was hoped that later more exact studies could be made, but there was never an opportunity for these.) The rough studies established the fact that, while the patient usually recognized five- to ten-letter words with the exposure of about a second, his failures were almost always with the final part of the word. Shown the word "slavery," for instance, he said only "s l a v." Shown the word "forced," he said:

> F o r c, but I don't know what the other. I get what I see. I get just about the first half of the word, but for some reason I don't get the balance in that time.

Such responses and his tendency to spell out the word rather than to pronounce it, indicated that he succeeded when he could get the word letter by letter, that he did not see it during the exposure as a whole. Only once or twice during the many tests did the patient, by suggesting two possible words for that which had been exposed, indicate that he had recognized the general form of the word. Once after the word "winter" was exposed for about a second he said:

> W–i . . . it was either "wither" or "winter."

Shorter exposures did not bring other such responses dependent upon vague appreciation of the word as a whole, but simply increased the number of complete failures and decreased the number of letters in the words partially right. Short phrases exposed for about a second could not usually be reproduced completely; the patient could give the first word and perhaps tell whether one or two words followed it.

In addition to the errors in oral reading which have been described above, there were still other types. Occasional confusions appeared as a result of the influence of the preceding or succeeding words. An earlier word perseverated unchanged, or contaminated a later one; or the patient made a mistake through anticipating a coming word, and read, for instance, "not other" for "no other."

In general he did not "improvise" as he read, suggesting words which were wrong but still fitted the content. He sometimes, however, substituted words related to the printed words, reading "home" for "house," "month" for "week," "thick" for "thin," and even breaking into the word structure to read "dislove" for "dislike." In their evident relation to the correct words these substitutions were like many of the verbal substitutions of speaking.

While the above paragraphs have dealt with the patient's oral reading, and in large part with the more mechanical factors in the reading process, those which follow have to do with his *understanding of reading*.[2] They are not, however, studies of silent as opposed to oral reading, for No. 22 always tended to read aloud. Especially in the early weeks of the study he would very quickly slip into oral reading after explicit directions to the contrary. If silent reading were again required, he would then read subvocally, but these attempts would rapidly become audible. Asked if he preferred to read to himself or to read aloud, he said that it was harder "to read inside" because "when you get to the end why you forget the back." Undoubtedly his most valuable cues, not only for the pronunciation of the word but for its meaning, were auditory. His tendency to avoid subvocal reading would show that predominantly kinaesthetic cues were not satisfactory substitutes for the auditory.

No. 22 was fairly successful with the two simplest tests of reading comprehension, but required a quarter to a half again as much time as that allowed for primary school children. The tests are of course far too easy for the literate adult. Eight weeks after the attack and again fifteen weeks after the attack, the patient's performances were substantially the same (Gates Word Recognition Test, 43 of 48 items correct; Word, Phrase, and Sentence Reading Test, 30 of 35 items correct). In both types of test his often faulty reading was aided by the pictures; he did not have to interpret the meaning independently but could select from four given words that which represented the picture, or from four pictures that which illustrated the phrase or sentence. Thus he read "Bridget . . . brachet . . . brotchet and skates," looked at the pictures; put his finger on that of the basket and skates, and said: "A basket, oh! now that basket I couldn't get that right." As a consequence of his naming difficulty, he sometimes described the picture incorrectly; these confusions did not always lead to a wrong solution for when he had read accurately and understood the meaning of the words, he was able to correct his interpretation of the picture.

Naturally enough, on reading tests which depended less on the selection of one of four possible interpretations and more on the patient's own interpretation, No. 22 always had greater difficulty. At first he could do only half the items of the Gates Reading of Directions Test and he could not give one correct response on the Thorndike McCall Reading Scale. After attempting the latter, he complained:

> Those hard words there . . . you work a little while and then forget the other line. . . . The trouble is I don't get enough of read to that to see it. Now if you read that to me, I'd go to it right away. My eyes are not clear enough to get the thing out of it that it means.

In other words, the reading itself, the hesitation over single words, the spelling out of words, etc., required so much effort that the words just preceding were forgotten. There was no simple process of forgetting, however; the earlier words were not only lost and perhaps equally difficult on a second attempt, but verbal confusions entered in as a positive destructive factor. Similarly, earlier parts of a passage in perseverating disturbed the response in the later parts.

---

[2] No. 22 had as much difficulty in reading what he had himself written as in reading other material. Even in reading a column of easy words which he had written very clearly, he would make many mistakes and miscall letters in spelling out the word. In reading papers he had written, the fact that he had the substance of the story in mind and could repeat it, did not prevent his making gross errors in the reading, even in the key words.

The tests repeatedly demonstrated the complexity of the disorder. On the one hand, the patient sometimes understood in spite of extremely faulty reading, and on the other hand, he might not understand even with perfect reading. An example of this second condition appeared when he again tried one of the paragraphs of the Thorndike McCall Scale, beginning:

> On Monday Dick saw a red fox, a gray squirrel, and a black snake in the woods.

He answered the first question on that paragraph as several other aphasic patients did, by giving the boy's name as "Monday Dick." Apparently "Monday Dick" through the arrangement of the words and the capitals, was more easily integrated than "On Monday," and the relation once established was not corrected by the reading of the paragraph as a whole. It persisted until the patient read the question about the day on which the boy saw the mice. Then he said:

> On what day did he see the mice? On what day did he see the mice . . . on . . . on what day . . . well, this was Monday. I thought "Monday Dick" was the boy's name.

Such examples as this, showing an abnormal integration of the words and phrases and a consequent disturbance in understanding, were closely related to other failures which depended upon a limited appreciation of the meaning. One of the items of the Gates Word, Phrase, and Sentence Reading Test presented four pictures, two of girls skating, one of a girl sewing in an armchair facing a window, and another of the girl sewing in an armchair with a window behind her. One of these pictures had to be chosen to illustrate the statement: "A girl who is sewing has her back to the light." Each time No. 22 tried this item he was confused. The first time, after some difficulty, he read the sentence correctly and then said:

> Both of these girls are sewing. I tell you what I'm looking for; I'm looking for the light, but I can't find any light there.

The second time he read the sentence easily, but explained his difficulty in much the same terms. He always seemed to be looking for a "light" in the sense of a "lamp" and the window, which was clear enough in the drawing, never meant "light" to him. Many times in the reading tests, as well as in the vocabulary tests reported below, No. 22 seized a particular meaning of the phrase or sentence first and sometimes never went beyond this.

Many difficulties in reading comprehension were undoubtedly to be connected with the verbal and structural difficulties of speaking. The patient misnamed objects and he misnamed letters. He used words in speaking which were wrong but often related to the proper words, and these wrong words sometimes carried for him the significance of the correct word. Similarly in reading he misread words, but sometimes understood their significance just the same. Extremely important, however, was the fact that his understanding of words in spoken language was greatly superior to his understanding of the printed word. His tendency to read everything aloud probably arose from this superiority of his understanding of spoken language.

Another point of general significance was shown in the patient's attempts to read hard words by taking them letter by letter, in his responses in the short-exposure experiments when he failed to see the word-form as a whole but got only the first few letters, and finally in his understanding of the material when he seized a particular meaning or illustration rather than the more general.[3] His behavior would indicate that many words or phrases were either unrecognized as integral structures or that they failed to carry their ordinary significance. In his attempt to recognize a word, he analyzed the separate parts and tried to develop the whole word from them. He was often successful when he had got the parts correctly. In his attempts to grasp the meaning of a word or phrase, he hit on some particular aspect of the meaning and sometimes passed from a discussion of this to a more general meaning.

Writing. Although the handwriting seemed to be normal in form and in speed, there were changes in *spontaneous writing* like those of speaking but somewhat more serious. Verbal confusions appeared in writing; structural and grammatical confusions were more pronounced, and words were sometimes omitted as they were not in speaking. Furthermore, many of the written words were misspelled, and the frequency of such errors was to be contrasted with the very rare misformed words of speaking. The following record is characteristic:

> I am grad to write that I am feeling quite different a week ago when I came here. In looking at printing papers I am doing better each day. . . . I have been trying daily to say "scissors." I have known the word for years and am only getting the name once and a while.

The verbal confusions of writing, like those of speaking, often showed some relation to the correct word. The following examples were interesting:

They learned that Mr. —— was to *sail* by train to the South.
The president of the company *told* it would cost . . .
He *vacated* the automobile . . .
It was difficult for me to *announce* the word. (Pronounce.)

---

[3] The attempt to read hard words by spelling them and the nature of the tachistoscopic reading, with a certain number of the first letters recognized instead of the form of the word as a whole, would put this patient with the cases of "verbal" alexia. At the same time it must be noted that he had great difficulty in recognizing letters as well, that is, that he showed also a "literal" alexia.

In the first example No. 22 had clearly mistaken a word altogether; in the next two, he had made slighter errors which concerned the usage of the word rather than its actual meaning; in the last, he had altered the prefix, a not unusual error, and one which in some cases consisted of a grammatical as well as a verbal confusion.[4]

The grammatical and structural confusions were sometimes more severe than in the record above, and occasionally obscured the meaning of the passage altogether. In such a case, No. 22 himself in reading them over could make nothing of them. Usually, however, they were chiefly awkward and indirect expressions and alterations in the more or less stereotyped turns of speech. Many of the confusions might be classified in several ways and were thus difficult to define. There were two possible explanations, for instance, for the clause "I am feeling quite different a week ago when I came here"; the verb form could be changed so that the clause read "I felt quite different a week ago when I came here," or the preposition "from" could be introduced thus; "I am feeling quite different from a week ago when I came here." Both of these types of change appeared in other connections. Not only were the grammatical and structural changes very varied in nature, but they played a more prominent part at some times than others. An example of extremely indirect expression has already been given together with an example of very blunt expression in Section 2. On the whole, the important condition to be noted from the verbal and structural changes is their great complexity and variability even within one case, and their qualities as *changes* in expression rather than as defects comparable to developmental errors.

The letter errors in spontaneous writing and in *writing to dictation* were essentially the same except for the more frequent perseveration of a letter in the former. They were not ordinary difficulties in spelling. Indeed the patient's scores on tests of word and sentence dictation in the beginning of the study reached the medians of the normal group, and they improved slightly from month to month until the time of the attack of unconsciousness (Morrison McCall Spelling Scale and Stanford Dictation Tests). Nevertheless, although he surpassed the normal person in the spelling of some very hard words, he had unusual difficulty with occasional common words which he must have known well before his illness. For instance, he wrote "business" as "bushness," and could not change it although in rereading the paper, he pronounced the word correctly. In some cases, he obviously questioned his spelling. Once, for instance, he wrote the word "social," "the way I have always spelled it, s o c i a l, but some people spell it s o t i a l." The uncertainty was characteristic of other types of responses as well: he would finally give the correct name for an object and still not be certain that it was the name; and he would read a word correctly without being sure of it. When the automatic responses were broken down, he could not replace them by logical solution and feel confident of the latter. The disintegration in the automatic responses in writing was irregular, so that simple words were often affected and the patient spelled "could" as "cood," "much" as "mutch," "upon" as "uppon," "gold" as "gould." Notwithstanding these occasional errors, he spelled many difficult words properly.

---

[4] No. 22 made many errors on Language Usage Tests when he had to choose the correct word usage or the correct grammatical form, but some of these errors depended on poor reading.

In connection with the frequency of reversals in his reading, it was interesting to find that, while reversed letters or letter sequences formed only a small proportion of his writing errors (8 per cent as compared with 3–4 per cent for normal group), abnormal instances did occur. He several times wrote "on" for "no" or vice versa, or "ot" for "to." He sometimes wrote "p" for "b" and once or twice "y" for "h." In writing single letters to dictation he made very few errors, but once or twice confused "b" and "d."

He found mirror writing very difficult with either left or right hand, and he often failed to make the letters in the reversed position.

In *oral spelling* No. 22 was above the upper quartile of the normal group. He generally repeated the word first, and in spelling grouped the letters according to syllables. When he hesitated he would repeat the word and start again. Frequent tests did not show those errors in common words which have been reported above for written spelling. It would seem that the automatic processes were less subject to disturbing influences in oral than in written spelling. When the patient was asked to spell words backwards, he still made few errors; his relative success indicated that a disturbance in the automatic sequences did not become a really important factor unless it involved the written letters. These were difficult for him, and particularly because he could not, by reading, recognize the errors of his written product.

No. 22 thought *copying* from print into script an easy task, but his copy showed a few errors: word and letter omissions, word and letter confusions, reversals, and failure to dot *i*'s and to cross *t*'s. In copying he kept his place with the left forefinger or with a card, and usually referred to the text for each word. Sometimes he would write only part of a word and look back again for the final letters. His rate in copying was only about thirteen words a minute, as compared with the normal thirty, and after the second attack it decreased to eight or nine words a minute.

Arithmetic. The patient's score on *arithmetic computations* was close to the median of the normal group eight weeks after the attack and two months later almost reached the upper quartile (Stanford Achievement Computation Test). On separate tests of addition, subtraction, multiplication, and division he did about equally well (Woody Arithmetic Scales). He was able to do most calculations, even long additions and some simple fractions, with accuracy. For the simpler number combinations he was accustomed to add the number to be carried to the next sum or product without naming that sum or product first; he was both economical and accurate in the carrying process.

He was occasionally confused by other arithmetical methods. Several times when he had just completed long or difficult problems, he started to multiply two numbers of the multiplier instead of the right-hand number of the multiplier and the right-hand number of the multiplicand. He only once misunderstood the significance of the arithmetical symbols for the various processes, and he gave these symbols their correct verbal equivalents. He sometimes misread a number, however, but often corrected on a second reading.

No. 22 did less well with printed *arithmetic problems,* falling below the lowest quartile of the normal group at his first examination eight weeks after the attack and just above at a second examination two months later (Stanford Achievement Reasoning Test). Even this degree of success was surprising, however, in view of his extreme difficulty in reading. It was often obvious that he understood the problem in spite of faulty reading and persistent confusions in his restatement of the problem. The following example showed the extent of confusion which might exist together with a correct solution:

> *The problem:* A man pays the street car fare for himself and two friends. If the fare is 7 cents, how much change should he receive from half a dollar?
>
> *The solution:* A man pays s t r double e t . . . street car *money* for himself and two friends. If the fare is *fourteen dollar,* how much *strength* . . . how much change should he *offer to the man?* If the p a r e . . . a man *paid* the *price* car . . . a man pays the street car fare for *the money* . . . for himself and two friends. If the fare is seven *dollars,* how much *more* change *would* he *offer for a half* dollar . . . seven *dollars* for himself. If a man pays the s t r . . . I got that right first . . . a man pays the street car fare for himself and two *persons.* If the fare is seven *dollars,* how much *should* . . . how much change should he *give* from the half dollar? That's twenty-one cents he's paying out and he's giving him fifty cents, he ought to get back thirty-nine cents . . . no, twenty-nine cents.

In this continuous oral response he never hesitated long enough to read the problem to himself correctly. While he might have understood parts of it more accurately than his oral responses indicated, a great deal of the meaning must have been carried by incorrect words, such as "dollars" for "cents." Furthermore, it seemed probable that his comprehension of these printed arithmetic problems was relatively easier than his comprehension of ordinary reading because of the amount of thinking possible in numerical as opposed to the more general verbal terms.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS.[5] Language confusions appeared to some extent on all the language intelligence tests but they did not always destroy the value of the response. The number of correct responses on the *Oral Opposites Test* two months after the attack was only slightly below the median of the normal group, and two months later was slightly above; but each time the patient required longer than the median normal time. On the *Part-Whole Test* he was below the normal medians both in the number of correct responses and in speed. When difficult "opposites" were attempted, many of the patient's responses were confused, and his concept of the "opposite" of the stimulus word was often difficult to estimate. In one or two cases he certainly appreciated its significance; for instance, to the stimulus word "vertical," he said:

---

[5] Because of the difficulties in reading, and also the defects in naming, it is worth noting that the patient's performance in interpreting pictures was satisfactory at the XII-Year Level (Stanford Binet). There was no doubt that he recognized the general import of the picture. For example, shown the scene outside the country postoffice, he laughed and said: "These men have gotten a story . . . living in the country, they've come to the postoffice. I s'pose they're reading stories about the conditions of the day . . . they're all interested."

> We put him in the opposite direction—if I was vertical I'd be laid down here. (Gestured to indicate "horizontal.")

Responses like this were important because they showed an intelligent performance on a higher level than could be reached by verbal expression. The quality of the intelligent response, however, was less clear when verbal confusions appeared, as they did on many tests of building words from given letters, of giving differences or similarities between two concepts, or of enumerating a number of objects in a given class. When the patient suggested "cotton" and "sugar" among the names for animals, for instance, his error was a positive sign of verbal confusion but not of general intellectual deterioration. In his particular case, furthermore, high non-language performances were proof that no serious general deterioration existed.

Because of his severe reading difficulty, this patient's low score on the *Sentence Completion Test* was of doubtful significance.

A more interesting performance was that on the *Absurdities Test.* Whether the statements were read to him or by him, No. 22 fell below the medians of the normal group. His responses were usually either incorrect interpretations of the statement or irrelevant comments upon it. There was sometimes evidence of receptive difficulty: the patient did not "hear right enough to see if there's something in there." In other instances, there were signs of a limited understanding of the particular words of the statement, but no further understanding which would make the absurdity plain. The patient sometimes repeated enough of the statement to show that he had grasped it in the narrowest sense, as, for example, in the following response:

> *The statement:* An old gentleman complained that he could no longer walk around the park as he used to; he could now go only half way round and back again.
>
> *The response after hearing the statement once:* Well, has he been sick? Can go only half way and back again . . . but then again fellows are lazy.

In so far as the responses showed his understanding of the words in the narrow sense, with too little understanding of the statement as a whole to make the absurdity obvious, they were directly comparable to the normal failures usually attributed to inadequate intelligence. Naturally these defects in understanding did not indicate a general intellectual deterioration any more than did the verbal confusions, but they were definite evidence of disturbance of the higher processes of thinking in language terms.

No. 22 was so greatly handicapped by verbal and grammatical confusions that he fell among the poorest of the normal group in defining the words of the *Stanford Binet Vocabulary Test.* He did relatively better when he had to select that one of five printed words synonymous with the test word, but reached only the lowest quartile of the normal group on the *Thorndike Test of Word Knowledge.* As in ordinary reading, he failed to recognize words which he should have known, even when he pronounced them correctly. That he had some understanding of many of these words was clear from the fact that he very decisively rejected several of the possibilities offered and confined his attention to the others. There were many errors which resulted from his immediate understanding of the test word in a particular sense, and a sense which did not fit in with the general meaning of the word represented by the synonym. He expressed this difficulty by saying:

> Trouble with me is when I see the words (Pointed to the column of test words.) take the meaning I have . . . I just don't see anything over here (Pointed to the words from which the synonym was to be chosen.) to read about them.

The following examples were typical:

> *Conflict* . . . expedition . . . fight . . . flow . . . flow together . . . mistake . . . dismay . . . well, if you run your automobile down here and you run into a tree, it's a conflict. If you don't watch yourself and it's the same thing, it's a mistake. (Marks *mistake.*)

> *Confederacy* . . . that pertains to something in the old war; confederacy . . . league . . . consumption . . . plot . . . trust . . . disturbance . . . confederacy . . . well, that would be disturbance. (Marks *disturbance.*)

He was rarely able to shift from his particular understanding of the word to the more general meaning. He would often put more effort into explaining how the test word and his choice could be alike than in choosing the synonym in the first place.

Reproduction of verbal material. In reproducing verbal material immediately after oral presentation, No. 22 always fell slightly below the medians of the normal group. He was more nearly normal in repeating digits than in repeating words or sentences. He was poorer in repeating digits or letters when they had been presented on printed cards than when they had been presented orally.

Many incidental observations showed that the patient remembered tests he had had some time before. Some specific instances were striking in view of his extensive verbal confusions. During the third month of study, he went over the hundred words of the Thorndike Test of Word Knowledge. A week later, when he was given the test again to determine how much alike the two performances would be, he recognized some of the test words and could tell what word he had wrongly chosen as synonymous, and what other word he now thought correct.

He always remembered appointments and had prepared all the necessary material for them. When he had, through no fault of his own, been late, he would tell exactly how late he was and why.

Non-language performances. The patient's scores on non-language tests, both for speed and quality, ranged from the lower quartiles for the normal group slightly above the upper quartiles. The majority fell around the medians for the normal group. Many performances were correct or adequate in spite of confusion in the verbal responses accompanying them.

Eight weeks after the attack and again two months later he was generally below the medians of the normal group in the quality of his performance in filling in *formboards* and in his speed. His slowness depended partly on the fact that he could see no reason for working rapidly. There was no clear evidence of marked defect in the appreciation of form. He recognized a trial series of geometrical forms rapidly and without error; although he often could not name them correctly. For instance, he called a *triangle* a "three square" and spoke of a *rectangle* thus: "That's a piece . . . the ends are equal and the north and south are equal."

An important index of form perception has already been discussed in connection with reading, that from the *Gates Visual Perception Tests*. The results of these tests showed that, although the patient was below the normal in his scores on figure perception, he was nevertheless more able in the recognition of likenesses and differences between figures than between digit sequences or words.

The *Digit-Symbol Substitution Tests* gave another index of form perception. Here the patient had to compare and differentiate various figures and relate each to its accompanying digit. Although he made no errors, his scores were usually a little below the medians of the normal group. His performance was undoubtedly below his original level, but it was high enough to show that he had no such difficulty in differentiating these figures, the arbitrary "symbols," as in differentiating letters. Even with symbols the same in form but different in direction, and thus roughly comparable to the letters "b" and "d," he made no errors.

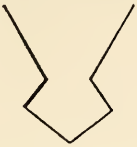
The additional difficulty which letter symbols involved was clear from a test of the Kuhlmann Revision, where the letters "q," "r," "s," "t" had to be crossed out in different specified ways as they were found through a page of pied text. The four letters placed at the top of the page were crossed in the correct ways by the examiner and remained as a key for the patient to use for reference. No. 22 was very much slower than the normal in this performance and made many more errors. His poor score was extremely significant in connection with his approximately normal scores on the similar tests which did not involve letters, the Digit-Symbol Substitution Tests.

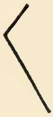
In *reproducing figures immediately after presentation,* the patient's performance was normal, showing again that he had no significant difficulty with figures or geometrical forms. He drew the Healy Visual Design roughly but accurately; one of the two Binet Designs correctly, and the other well enough for a half credit. His performance on the Kuhlmann Immediate Recall of Unfamiliar Forms was more important because it permitted of finer scoring, and here he fell slightly below the median of the normal group in accuracy, but slightly above in rate of drawing.

His discrimination of figures in a more natural situation was tried out with playing cards. During his illness, No. 22 spent much of his time playing solitaire. Although he had never played cards before, he understood and could explain the principle of his game. He sometimes made mistakes in playing, however, putting a black three on a red five, or failing to build on one of his ace piles when he had an opportunity to do so. His errors were probably no more frequent than those to be expected of a person unused to card games and playing only "to rest the brain." Certainly there were not enough errors to indicate any true abnormality in discriminating between the cards. The discrimination was correct in spite of confusions in naming, particularly in naming the face cards.

No. 22 surpassed the medians of the normal group in reproducing the pattern traced by the examiner on the basis of four cubes or four dots (Knox Cube Test and Imitation Test of Pintner Non-Language Scale). On second tests two months later, these performances were still higher, and he was then able to give an introspective report which showed that he was reproducing the series of movements by a verbal, or, more specifically, numerical method; that is, he was attempting to remember the pattern by counting to show the order in which the dots were touched.

In the *Reversed Drawings Test* of the Pintner Non-Language Scale, No. 22 surpassed the upper quartile of the normal group both on the first examination and on the second two months later. He thus did very well in spite of the fact that the problem was, as he said, "outside of my business altogether." Even in rather complex drawings such as that illustrated he was able to complete the second figure of the pair so that it would be just like the first, "only turned over." The task required far more than the simple recognition of figures which might suffice for the Digit-Symbol Substitution Tests. The form of the drawing to be completed had to be reconstructed, either visually or by some language formulation. The drawings in this case were completed without any of the oral comments which usually accompanied this patient's work. There might, of course, have been subvocal language formulations, but the extent of his language confusion would probably have rendered verbal aids in these complex performances relatively useless.





In response to picture tests, however, No. 22 made occasional verbal comments. On the test of *Picture Reconstruction,* where he had to study the disarranged parts of a picture cut into two, four, or six sections, and then indicate by numbers how those parts should be put together to make a good picture, he was again above the upper quartile of the normal group. Most of his verbal response here had to do with the number of the section he was going to place; he did very little naming of objects in the picture or describing how sections of the picture should fit together.

His scores on both the *Picture* and the *Drawing Completion Tests* were less good and fell slightly below the medians of the normal group. While looking for the blocks to fit in the empty squares of the Picture Completion Test, he made fragmentary comments which contained relatively few language confusions. As he looked for and drew the missing parts of the pictures of the Drawing Completion Test, he made no comment unless he could not understand what part was missing. At first, he could not see what was missing in the picture of the elephant, but after he had said that he failed, he quickly drew the ear, saying: "Here is a sort of . . . runs over like that." On the re-test he sketched mud guards to complete the picture of the boy riding the bicycle, overlooking the absence of the chain from the driving sprocket to the rear wheel. Later he returned to the picture and said:

> What he's absent of here . . . I didn't see before . . . is this thing that runs this. That's the southern part of the garage that makes for . . . the the pivot of the garage bicycles.

This completion of the bicycle picture, which was incidentally a difficult problem for most normal persons, was perhaps the best example of the verbal confusion which might exist with a correct response.

Marked language confusions in connection with good performances occurred in the *Stenquist Mechanical Aptitudes Test,* which required the assembling of various mechanical devices such as door-bells and locks. The patient's score fell within the highest ten per cent of the scores of army men on which the norms of the test were based; yet some of his good performances were accompanied by such confused language responses as the following:

> (As he connected the links of the chain, he said:) This always looked to me like some sort of cow people used to use . . . I don't know why they did it.

The patient's *drawing of a man* was crude and badly proportioned; he was unable to represent the shoulders properly. In spite of the correct detail of the features, the score for the drawing on the Goodenough Scale reached only the lowest quartile of the normal group.

No. 22 drew a map of the part of town around the hospital, marking the important streets and drawing accurately the boulevard which cut through the other streets obliquely. When he was shown a panorama of that part of the city near the hospital, he was able to point out the streets correctly and to indicate his recognition of the more important buildings, either by direct naming or by commenting on them. In drawing a plan of his house and garden, however, he represented three of the downstairs rooms in cross-section, but drew the windows of the fourth as they would look when seen from the outside.

No. 22 traced all the *Porteus Mazes,* including the two adult forms, and was thus superior to the upper quartile of the normal group. He worked slowly and sometimes stopped at a crucial turn in the path to comment that he had to "watch every one" he went in, or that two of the three ways were "stuck."

A *survey of all the non-language performances* showed that they were affected unequally; that some were relatively well preserved when others were certainly below the patient's original levels. The best non-language performances reached or surpassed the upper quartiles for the normal group. They were thus at higher levels than any of the language performances. On the Gates Visual Perception Test which provided a direct comparison of similar performances with verbal and non-verbal material, the patient was always closer to the normal with the non-verbal work. Within the group of non-language tests, there was no evidence that the poor non-language performances occurred in the most complex or abstract problem; no evidence, in other words, that the non-language performances were affected in proportion as they involved language formulation. As a matter of fact, the different levels of the non-language performances did not correspond to any clear-cut divisions according to the nature of the problem involved. The patient's visual or logical reconstruction as it appeared on the Reversed Drawing or the Picture Reconstruction Tests was more successful than the construction required for the formboards where there had to be actual manipulation of the material. This was the opposite of the usual relation. A more usual condition appeared in the patient's success with drawing of a reproductive nature as compared to his representative or constructive drawings. In short, there was no evidence that the non-language difficulties could be laid to language disturbances, but it was apparent on the contrary that good non-language performances often occurred when the language responses accompanying them were confused. The general facts therefore remained: 1) that the patient's highest indices of intelligent behavior after the attack were to be found in non-language performances; 2) that some non-language performances suffered deterioration which could not be attributed with certainty to the language disturbances; 3) that language disturbances sometimes appeared together with adequate non-language performances.

6. A COMPLEX DISORDER WITH LIMITATIONS IN RECEPTIVE PROCESSES AND PARTICULAR DISTURBANCES IN REPEATING AND WRITING TO DICTATION: CASE NO. 28

The two preceding cases, No. 31 and No. 22, both illustrated serious receptive difficulties together with characteristic expressive disturbances. The receptive difficulty in the case of No. 31 was more marked in the understanding of spoken language, but, as is usually the case, there was comparatively little difference between the degrees of limitation in the two receptive processes. No. 22 illustrated the unusual condition in which the one receptive process is far more affected than the other. A survey of the cases of the predominantly receptive group shows other variations besides those in the relative disturbance in the two receptive functions and in the severity of the disorder as a whole. There are a few cases in which at the time of the examination structural confusions of speaking were at least as prominent as the receptive disturbances. There were other rare cases resembling the typical predominantly receptive disorder in most of its essential characteristics, but differing from it in some particular phenomena. Of these the most interesting were probably those whose performance in repeating did not correspond to the level of the understanding of spoken language.

One of these cases, No. 28, is sufficiently different from the predominantly receptive patients described above to warrant reporting. He had as much difficulty in repeating and more difficulty in writing to dictation than other patients whose receptive functions were far more limited and whose spontaneous expression in speaking and writing was more confused.

No. 28. *A case of predominantly receptive disorder with particular difficulty in repeating and in writing to dictation. The lesion was probably cortical, resulting from hemorrhage in the central and temporal convolutions.*

Male, white, 44; previously a steam-fitter, but at the time of the examination had a part-time painting job for which he used the left hand; about five years of schooling; right handed, but had developed considerable skill with the left hand during the two years and a half after the attack.

Psychological Summary

The aphasia was predominantly receptive, and there were particularly severe disturbances in repeating and in writing to dictation. Spontaneous speech was easily and well articulated, but the expression was fragmentary and somewhat repetitious; it was often handicapped by difficulties in evoking the necessary words and by verbal confusions and awkward constructions. Expression in writing was not so natural or complete as in speaking, and usually contained some passages so confused as to lose their meaning.

No. 28 experienced about equivalent difficulty in the understanding of spoken language and of printed material. Although he often could not follow ordinary conversation, he usually understood simple statements of eight or ten words. He could not follow directions involving the understanding of spatial terms and right-left adjustment. He was unable to repeat long words or sentences of as many as six syllables, and he only rarely succeeded in writing a single word to dictation. Of all the disturbances, that in writing to dictation was the most extreme.

Although still able to handle many number combinations, he fell among the poorest of the normal group on arithmetic tests; his failures resulted largely from difficulties in recognizing either the symbols for the arithmetical processes or the processes necessary to solve given problems. As the extent of his language confusion would indicate, he did very poorly on most language intelligence tests. His responses on these, as on other tests, showed considerable perseveration.

His non-language performances ranged from low levels to levels around the medians of the normal group; the best of them were clearly superior to any of his language performances. Their superiority will be evident from a study of Figure 11, page 265, where his performances are represented in terms of the variability of the normal group. His scores on reading and spelling tests were so low that they were really outside the normal distributions. The relatively high scores on the oral vocabulary and on the non-language tests, however, show that in spite of extensive language disturbances there was no general deterioration.

The patient was first examined two years and a half after the attack.

Very little could be ascertained about his condition during these years, but there had at first been a serious loss of speech together with an extensive reading difficulty. The latter had regressed only very gradually. During the five months of study, he changed only in those performances specifically trained, namely, in the facility of his handwriting and in arithmetic computations.

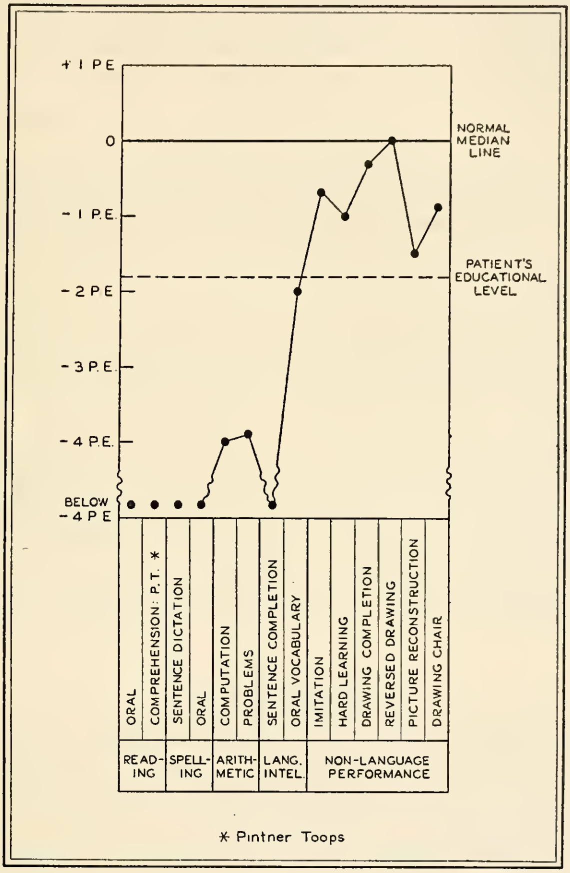


Figure 11. Performance levels: Case No. 28, receptive

No. 28 was extremely cooperative: he came weekly to the clinic at the designated hour, worked steadily during the examination and was anxious to practice reading, writing, and arithmetic at home. He was well oriented and experienced no difficulty in traveling on trolley cars alone; several days a week he went to his old place of work to do odd painting jobs. At the same time he was obviously unaware of the severity of his disorder and far more cheerful than his condition warranted. His social perceptions on the whole seemed to be dulled, but he occasionally made pertinent comments on the physicians who attended him.

Neurological Summary

Two years and four months before the patient was observed in the outpatient clinic in the University Hospital, he suddenly became unconscious and remained so for ten days. On recovery he had a right hemiplegia with aphasia.

When first examined in the clinic he had the usual right hemiplegic symptoms with increase of tone, reflexes, and Babinski. There were no sensory disturbances. Eye examination was negative. The blood Wassermann was negative.

His psychological studies were begun two years and nine months after the onset and continued over a period of five months. The neurological symptoms were stable. The only additional point of interest was that the patient complained of involuntary laughter.

The diagnosis was probably a hemorrhage in the left brain in the motor temporal area.

Psychological Report

SPEAKING. *Spontaneous speech* was freely and accurately articulated, but the expression was fragmentary and sometimes indirect and handicapped by occasional hesitations for words or by verbal confusions. Often when the patient's expression was inadequate, he would supplement it by good descriptive gestures. The following record was a typical example of the spontaneous speech:

> (After attack) I was a goner, I was. My speech . . . everything else gone right away . . . two weeks . . . my wife thought I was gone . . . . I can't read at all. In the *Bulletin* I can explain it better now. I can talk two or three things . . . yeah . . . I try every night.

The patient's speech showed a certain amount of perseveration which probably reflected the condition of his thinking: he did not pass rapidly and directly from one idea to the next, and he repeated stock phrases such as "I try hard" many times during each examination.

Once he had grasped the problems, he gave *automatic word series* fairly well; he counted and said the days of the week and months of the year correctly. He failed to say the alphabet correctly aloud, however, and he made several errors in placing a set of block letters in alphabetical order.

Naming. No. 28 named correctly about 80 per cent of the objects or colors or pictures of the lists given him (Head's Tests of Object Naming and Color Naming and the Kuhlmann Line Drawings). He was about equally successful in picking out the given item by oral or printed command. When he failed to name correctly, his errors were sometimes misformed words such as "drummel" for "drum" or "perch" for "purse," but more often true words incorrectly applied. It was characteristic of his errors in naming, as in reading or in writing to dictation, that they often remained within the sphere of the correct name. He gave "finger" for "hand," "dog" for "horse," "pen'n ink" for "inkbottle" and both "bracelet" and "scarf" for a "chain" around the neck. When he failed to get the name himself, he was usually able to reject the wrong names suggested to him, but he often did not accept the right one with certainty.

Repeating. No. 28 rarely failed to repeat single words of one or two syllables, and his articulation was good. When he attempted long words or sentences of six syllables or more, his articulation was still good, but he omitted or confused words.

Understanding spoken language. The patient understood spoken language about as well as he understood printed material; in both receptive functions he was far below normal. Nevertheless he could pick out the correct one of four pictures to illustrate sentences such as: "A roof of a house is burning" or "A boy and two other people are in an automobile" (Gates Word, Phrase, and Sentence Reading Test, given orally).

His understanding was less satisfactory when spatial terms were involved. He was never certain of "left" and "right" and he often could not show his left or right hand at command. He failed altogether with more complex directions requiring a right-left orientation. Asked to put the "left hand to the right eye," he picked up his useless right hand and lifted it to his head. Asked to put the "left hand to the left ear," he was unable to make the response although in the very beginning of his attempt he repeated the command accurately. He was not successful with any of the spatial directions of the Kuhlmann Comprehension Test, Year VIII, even in the one case here when he repeated the direction correctly.

Reading. No. 28 misnamed only one or two letters in any random arrangement of the alphabetical series, and made about the same proportion of letter errors in spelling out words which he could not pronounce immediately in reading.

On an *oral reading* test, the patient pronounced correctly about 60 of 100 single words of graded difficulty (Gates Pronunciation Test). His performance was irregular in that he failed many of the relatively simple words when he was able to pronounce some difficult words such as "commonwealth" and "university." It was further unusual in that most of his errors were word substitutions; he read, for example, "paper" for "wall," "culture" for "glorious," and "cleaner" for "glitter." No regular controlling factors were apparent in these substitutions; there were form, sound, and meaning relationships. The latter are the more difficult to explain. In the "paper" for "wall" confusion, there was nothing in the patient's earlier reading to suggest "paper." Its occurrence might of course have been chance, but there were more substitutions with a meaningful relation to the given word both in reading and in writing to dictation than chance would explain. It seemed probable that the patient did not perceive the stimulus word clearly or continuously enough to give a normal reaction; that the stimulus gave rise to a group of words which were not sharply differentiated and that one of these, not always the correct one, was brought out. The erroneous substitutions in reading were sometimes rejected spontaneously; in a few cases they persisted even when the patient had spelled out the printed word correctly letter by letter.

Although superior to them in his former knowledge of reading, the patient read as slowly as the poorest of the literate normals, and made as many errors (Gray Oral Reading Paragraphs). His errors, however, were of a different character; they consisted almost entirely of substitutions of words or phrases for those given in the text. A sense of relation between the printed word and that substituted by the patient was much more frequent than in his errors in reading separate words. Often the general meaning of the sentence was preserved; for example, he substituted "The trees an' grass is beautiful" for "The trees are green and pretty."

The patient's *comprehension of printed material* was relatively satisfactory; he reached a higher level in selecting one of four words to represent a picture and in selecting one of four pictures to illustrate a sentence than in any of his oral reading (Gates Word Recognition and Word, Phrase, and Sentence Reading Tests). Although he was far below normal in both, his understanding of the sentence was slightly superior to his understanding of the single words.

WRITING. The patient's *spontaneous expression in writing* was sometimes incoherent, as his speech never was. In the following letter clear statements were followed by phrases so confused as to lose their meaning:

> Dear Sir:
> I am going to Wildwood for a week, going to the beach, the matter few mine it is a fine day. I am going home together.
> Best wishes
> Your Frined
> Jack

Despite the confusions and inadequacies, the quality of his expression and the accuracy of his spelling in spontaneous writing were very high in comparison to his performances in *writing to dictation.* When single letters were dictated, he always responded by writing a well-formed letter but about half of these were the wrong letters. When single words were dictated, he wrote a word, but almost never wrote that which had been dictated. More than half the time his productions were true words, but he also wrote garbled and unrecognizable word-forms. There were many instances of perseveration from earlier responses. Although there was usually no apparent relation between the word dictated and the word he wrote, some few of his showed form or sound relation to the dictated word and a slightly larger proportion were in the same "sphere" as the dictated word. The patient, for instance, wrote "he" for "she," and "thigh" for "foot." Another example is interesting because his oral response showed that he perceived the word well enough to repeat it. Following the dictation method of the Morrison McCall Spelling Scale, the examiner pronounced the crucial word; used it in a sentence and pronounced it again alone, thus: *"His,* his arm is broken, *his."* The patient said: "His arm? His"; and very quickly wrote "leg." Here as in some of the confusions in reading, the stimulus may have aroused a group of words which were not sufficiently distinct so that the correct one could be held for a sufficient length of time.

His errors, however, did not usually depend simply on an inability to retain the dictated word. He tended to repeat it correctly before writing and again afterwards. Although he was sometimes uncertain about the accuracy of his response, his second repetition usually seemed like a check on the written word and he apparently accepted such gross discrepancies as "together" for "over," "how" for "six," and "is" for "ran." Sometimes after first repeating the word, he attempted to spell it orally. The oral spelling was almost always garbled; it fitted neither the dictated word nor that which he finally wrote. In response to the word "sick," for instance, he repeated "sick" correctly; spelled out "c h i m e"; wrote "tink"; and again repeated "sick" correctly. Almost his only success in oral spelling appeared when he himself set the problem, when, for example, he was naming an object or defining a word, and spelled it aloud, apparently as proof of his competency. The patient had as much difficulty spelling words by selecting block letters from an alphabetical arrangement as he had in writing them.

In sentence dictation his difficulty was so great that he usually wrote only part of a word. Even if the sentence were short, he could not "remember" it, nor "explain it" to himself. If he managed to write several words, it was apparent that they were confused much as were the single words dictated.

No. 28 made a number of errors in *copying,* generally through substituting one word for another. The words he substituted were sometimes to be found in nearby parts of the text. In copying he also made some letter errors, substituting "p" for "b," or omitting a letter or reversing the order of a pair of letters.

The most striking conditions shown by his performances in writing were, first, the great superiority of his spontaneous productions in comparison to the dictated letters, words, or sentences; and second, the fact that his errors in writing to dictation went far beyond spelling errors, and were obviously a complex product of his language confusion. Even when he repeated the dictated word correctly, and when it was one he had earlier written perfectly in spontaneous writing, he was usually unable to write it to dictation. His responses showed only slight and occasional control through form or sound or sense by the dictated word.

ARITHMETIC. When first examined, No. 28 fell among the poorest of the normal group in his performance with *arithmetic computations* (Stanford Achievement Computation Test). Although he made some errors in simple number combinations and carrying, he obviously knew the mechanics of carrying. His poor performance depended to a great extent on his confusions about the arithmetical symbols and the verbal terms for the different processes. After two weeks' practice in arithmetic, he raised his score almost to the lower quartile of the normal group and his improvement was largely the result of his new understanding of the symbols and verbal terms for the various processes. He usually had more difficulty understanding these terms when computations were presented orally than when he worked at printed examples.

His first performance on printed *arithmetic problems* was also near the level of the poorest of the normal group, and was raised only slightly by his two weeks' practice in arithmetic computation (Stanford Achievement Arithmetic Reasoning Test). He failed to understand many of the relatively easy problems well enough to choose the correct process for their solution. His performance with oral problems was much like that with printed.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. As the extent of his language confusions and inadequacies would suggest, the patient did very poorly on language intelligence tests. On the *Opposites Tests,* he could give only about four of twenty responses correctly. He sometimes failed to understand the stimulus word, even once or twice when he repeated or pronounced it correctly; he several times lost the controlling principle "opposite" and gave a "free association" from the stimulus word; toward the end of the tests one response which had earlier been correct perseverated many times.

On the *Jaederholm Classification Test* he never suggested objects outside of the given class, but he was unable to produce names of enough objects to reach the standard VIII-Year performance.

His score on the *Sentence Completion Test,* which was below that of the poorest of the literate normals, represented such a poor performance that little could be determined about the nature of his difficulty.

He fell among the lowest of the normal group on the *Oral Vocabulary Test* of the Stanford Binet. His limitations depended not only on difficulties in expression, but on true failure to recognize the words.

REPRODUCTION OF VERBAL MATERIAL. No. 28, although he generally repeated single words accurately, was very much limited in the extent of the material he could repeat without change. He succeeded in reproducing series of only four digits or two disconnected words, and phrases of only five or six syllables. When the sections were longer, his product was abbreviated and confused. Given, for instance, the sentence "When the train passes you will hear the whistle blow," he said: "The train's prace is the whistle blowing." He could repeat accurately only as much as more typical receptive patients whose understanding of spoken language was much less adequate than his.

Non-language performances. The patient's non-language performances ranged from levels almost as low as the poorest of the normal group to levels around the medians of the normal group. The higher ones were thus superior to any of his language performances.

He worked very slowly in filling in the *formboards,* and his scores were below the medians of the normal group. He was seriously handicapped here by the enforced use of his left hand, but the poor quality of many of his performances showed disturbances in the recognition and purposive construction of forms quite apart from his manual handicap.

He worked so slowly on the *Digit-Symbol Substitution Tests,* writing in the numbers with his left hand, that he fell at or below the lower quartiles for the normal group. On the complete Woodworth Wells Substitution Test, which was longer than any of the others, he gave a good performance from the point of view of learning, for toward the end of the test he rarely had to look back to the key at the top of the page, and he cut his time per line almost in half.

No. 28 fell below the median of the normal group in *imitating patterns* traced by the examiner on a row of four dots (Imitation Test of Pintner Non-Language Scale). He started off well but soon began to repeat part of the same pattern again and again. After he had begun seven different items the same way, he stopped short, said: "I draw it alle time; that ain't right"; and then gave the next response correctly. Perseveration appeared often in the language performances, where it was apparently not recognized, but was rare in the non-language performances.

No. 28 reached the median of the normal group on the *Reversed Drawing Test* where he had to complete a second drawing so that it looked like the first one of the pair only "turned over." It was impossible to determine whether he managed this performance by visual or perhaps partly kinaesthetic reconstruction of the figures or whether he used a logical method with verbal formulation. In view of his inadequate verbal expression the former was certainly the more likely. It is interesting that he should have been able to reproduce the figures in their reversed directions when he was so extremely confused on the Kuhlmann Comprehension Test which demanded a right-left upper-lower orientation in verbal terms.

No. 28 did relatively well on the *Picture and Drawing Completion Tests.* His score on the Picture Completion Test of the Pintner Performance Scale was slightly higher than the median of the normal group. Most of his selections were accurately and purposefully made. When looking for a block to fill in the hole where the window should be, he considered the one showing the broken window and the one showing the unbroken and curtained window, and quickly and correctly chose the former because of the pieces of glass pictured on the ground below the window space. His score on the Drawing Completion Test, which fell just below the median of the normal group, would have been higher if he had been able to make the drawings more accurately. He was clearly superior to the median of the normal group in his recognition of the missing parts. A median performance, furthermore, meant a good performance for this patient, because he was below the median of the normal group in education and occupational rating.

No. 28 made a fairly satisfactory *drawing of a chair* from a model. His drawing lacked perspective, but it indicated all the necessary parts in rough proportion; in score it was almost up to the median of the normal group.

The patient's performance in tracing the *Porteus Mazes* fell among the poorest quarter of the normal scores. His difficulty was not so much failure to look ahead as inability to see the path when he did look ahead. Once he stopped, saying, "This is finished," and showed all three blocked paths. Even then he could not find the fourth, the open path.

7. SUMMARY

The patients of the predominantly receptive group show more or less serious disturbances in the perception and understanding of spoken language and of printed material. Sometimes the one receptive process is more seriously affected, sometimes the other. There is never an absolute loss, however; the extent of the understanding, whether of spoken or printed material, varies according to the circumstances, being greater in situations most familiar and interesting to the patient.

Difficulty in understanding is usually most complicated by defective perception of speech sounds or printed symbols in cases of serious disorder. There is, however, no regular relation between correct perception of the word and satisfactory understanding.

Patients whose understanding is limited often grasp a part of the statement and react on the basis of this. Others whose receptive disturbances are less severe, like many of the patients of the predominantly expressive group, understand the specific words of the statement but fail in the further intellectual process through which the appreciation of its whole significance develops.

The expressive defects of the patients of the receptive group consist largely of verbal and grammatical and structural confusions, hesitations for words, and indirect expressions to compensate for the words which cannot be evoked. Although it lacks continuity and coherence, speech is free and plentiful; writing is also plentiful but often shows more severe verbal and structural confusions than speaking. In both forms of expression, particularly in severe cases, there are likely to be a certain number of misformed words comparable to the frequent misformations typical of the predominantly expressive group.

The expressive defects usually vary in severity with the extent of the receptive disturbances, but they may be slight when understanding is seriously limited, or they may be or remain considerably affected when the patient understands fairly well. In the latter case, which is very rare, the disorder is still termed "predominantly receptive" because the particular expressive defects are those characteristic of predominantly receptive aphasia and infrequent in predominantly expressive aphasia.

Performances on language intelligence tests fall around the levels of the simpler expressive or receptive responses; but, on the one hand, the actual "reception" is sometimes satisfactory when intelligent grasp of the material is insufficient and, on the other hand, expression is sometimes faulty when the patient can show his comprehension of the intellectual problem and its solution by gesture or paraphrase.

Non-language performances are on the whole superior to the language. Like the language performances, they vary from low to high, but they have not the close relation to the receptive and expressive disturbances which the higher language performances have.

Some of the patients of the predominantly receptive group were well adjusted to practical situations and actual living conditions; others had not made satisfactory adjustments and showed considerable emotional disturbance. There was no general tendency throughout the group.

Three cases are presented to illustrate the characteristics of patients of the predominantly receptive group. The first, No. 31, with the serious receptive difficulties and the characteristic changes in expression, is probably the most typical case, yet he does not, of course, represent a fixed type within the predominantly receptive disorders. Such subordinate types do not exist except in the sense of greater prominence of some of the disturbances than of others. In the second case reported, that of No. 22, there was a different picture because of the extreme disturbances in reading. Furthermore, in this case the understanding of spoken language was relatively well preserved. The third case, No. 28, presents another variation; in addition to limitations in receptive processes, there were marked disturbances in repeating and in writing to dictation.

X

TYPES OF APHASIA: THE EXPRESSIVE-RECEPTIVE

1. The nature of the expressive-receptive disorders
2. A severe and extensive disorder: Case No. 37
3. A severe disorder in which all language performances are extremely limited, but many non-language performances satisfactory: Case No. 15
4. A disorder in which language performances are limited and non-language performances high: Case No. 27
5. Summary

1. THE NATURE OF THE EXPRESSIVE-RECEPTIVE DISORDERS

THE patients of the expressive-receptive group were set apart from the others by the severity and extent of their language disturbances. In each case both expressive and receptive processes were so seriously limited that the expressive could not be held superior to the receptive or vice versa. Conditions like this may of course represent only the most severe stages of a disorder which, as it retrogresses, becomes predominantly expressive or predominantly receptive. Two of the twelve cases classified with the expressive-receptive group, No. 2 and No. 8, were examined for comparatively short periods during severe stages of the disorders, and might earlier or later have belonged to another group. The other ten, however, were true cases of expressive-receptive disorder; eight of them did not change over long periods of time, and the two who showed some gradual slight improvement were still limited in all language performances and could not be characterized as either predominantly expressive or predominantly receptive.

The expressive defects were sometimes so great that the patient could utter only a few speech sounds or a word, or print a few letters. In no case, however, were all signs of language expression lacking. The limitations in speaking were naturally like those of the severe cases of expressive disorder. Propositional speaking was most affected. Only a few patients were capable of any true propositional statements; and even these had few words at their command, expressed themselves very inadequately in abbreviated phrases which they usually supplemented by gesture, and were often handicapped by difficulties in articulation. A few other patients who were incapable of propositional speaking could use one or two particular words or phrases at will. In some cases the phrase was a true speech expression, "Oh my!" for instance, or "No sir!"; in other cases it was a more or less stereotyped combination of speech sounds such as "enna-enna" or "kinakootch." The most superior patient used his phrase, "Atta boy," only in appropriate situations, or in such a way as to show that he recognized it was unsuitable but wanted to make some speech response. Other patients who had the use of some characteristic phrase, whether a true speech expression or a combination of speech sounds, generally produced it in a variety of situations, and often treated it as if it were adequate. The combinations of speech sounds were sometimes inflected in different ways at different times, exactly as if they were true and appropriate responses. Occasionally, however, the patient would show his dissatisfaction with them by gestures and facial expressions of disgust and dejection.

In these expressive-receptive disorders with their serious speech limitation, there is excellent opportunity for observing the "lower" forms of speech response, which appear in addition to the propositional speech or when it is altogether lacking. The nature of these inferior speech responses is the same in the expressive-receptive disorder as in any other. The patient may swear or use other emotional phrases or make some remark arising from emotional excitement. One of the patients, for example, when repeatedly urged to do something he could not do, cried out, "No, I can't do that!"—a response which he could not produce either as a whole or in part under ordinary conditions. Another type of inferior response arises as part of the natural reaction to some situation. This "reactive" speech, as it was designated in the chapter on expressive disorders, appears for example when the patient uses the phrase "Good-bye" if someone is leaving him, but cannot produce that or any similar phrase at will. Still another type of response which may be possible when speech is extremely limited, consists of automatic word series such as counting.

In patients of this group speech of any kind is often so scarce that defects in the articulation and formation of words constitute only a minor problem. Nevertheless these defects may be serious. Some of the patients were like many of the predominantly expressive group in the effort with which they uttered words and in the defective word-forms they finally produced.

Their difficulty sometimes extended to the words in emotional or automatic speech. Often, however, the special phrase which the patient could use at will was produced with ease and freedom when other attempts at speech response were accompanied by great effort.

Limitations in writing were usually about as great as those in speaking, and the written product in every case revealed defects similar to those of speaking: words were misspelled and sometimes grossly misformed, and phrases and sentences if they were achieved at all were abbreviated and incomplete. In some cases, however, there were differences between the two forms of expression. Apparent differences in favor of speaking arise from the unequal roles played by the inferior speech responses in speaking and in writing. When propositional speech is negligible, spoken expression may nevertheless be frequent and even varied as a result of emotional, reactive, or automatic expressions. These naturally do not appear to the same extent in writing, where the only automatic responses, in general, are the patient's name, possibly his address or his wife's name, and perhaps the number series. Only one patient ever made a response in writing comparable to the frequent speech responses which arise from emotional excitement. This patient with obvious excitement tried to explain to the examiner something which was incomprehensible either from his gestures, his swearing, or the reiterations of his particular combination of speech sounds. He then hurried to the table, picked up a convenient pencil and wrote the word "wife." He had been trying to explain that he could not work because his wife was waiting to visit him. This instance of satisfactory communication in writing when speech failed was a significant example of a superior emotional response in writing because the patient could not at the time write any words correctly; even his name was misspelled.

There are patients, however, who show an actual and very clear and regular superiority in writing. In this expressive-receptive group, there were four such patients. One, No. 45, could write and copy several letters of his name at a time when he could not produce any true speech sound. Three others habitually carried writing tablets with them and communicated by writing and gesture. In only one of these cases, however, that of No. 27 who is reported in Section 4, was the writing at all satisfactory as a means of expression. Nevertheless it is an interesting fact that expression in writing remained superior to that in speaking for three patients no one of whom had been particularly skilled in writing before the disorder.

Receptive processes were limited in all cases of the expressive-receptive group, and always more seriously limited than in cases of the predominantly expressive group. Most patients were not always able to grasp single familiar words, and their responses to various tests showed difficulties both in perceiving the speech sounds and in understanding the meaning of the word. Many were more successful when they knew the words to be names of a limited number of objects presented in a group, as for Head's Object Naming Test. Many understood some questions or directions, particularly, as in all other types of disorder, when the material dealt with natural or personal matters. In general, responses to printed material indicated equally serious disturbances, but some patients could understand more by ear and others more from reading. The three patients mentioned above who were most successful in writing were also superior to the other patients of the group in reading comprehension.

In most cases arithmetical performances were affected commensurately with the other language responses. There were several notable exceptions, however, several patients whose work on printed arithmetic computations was superior to that in any other language performance. One of these, No. 19, made a score above the lower quartile of the normal group on the printed arithmetic computations test, and for all the patients of this group this was the only performance directly involving language symbols which exceeded the lower quartile of the normal scores.[1] The symbols involved are, of course, largely numerical. It is evident that at least in some cases of serious and extensive language disorder, the numerical symbols can be manipulated more readily than other language symbols. In the case of No. 19, and also that of No. 27, the scores for arithmetic computations fell at levels between those of the language and those of the non-language performances.

When expressive and receptive processes were so defective, there was usually no question of higher language performances. The two most able patients of the group, however, who could understand a number of words in print, attempted the controlled association tests, and in some instances showed, as predominantly expressive patients did, that they could indicate the correct "opposite" or other response by gesture. It was apparent then that a concept they could not express verbally nevertheless existed for them to some degree.

---

[1] The record for No. 19 is presented in Appendix I, pages 548 ff.

The greatest differences between patients of the expressive-receptive group appeared in non-language performances. While these were always above the language as a whole, their superiority was slight in some cases and great in others. Thus, although there was never equivalent deterioration in all performances, there were some instances of rather general deterioration and others of sharp distinction between the levels of intelligent behavior as determined by the language and by the non-language tests. The differences within the group and the individual patient's ability on non-language tests are best shown in relation to the performances of the normal group. For the purposes of comparison fourteen language and fourteen non-language performances were selected as criteria. It was then possible to calculate for every individual the percentages of performances of each type reaching or exceeding the lower quartiles, the medians, and the upper quartiles of the normal group. These percentages are represented graphically in Figure 12, page 280. The one language performance reaching the lower quartile of the normal scores appears on the lower base-line: it is the score on arithmetic computation for No. 19. The very different condition among the non-language performances will be immediately evident from a study of the upper section of the graph. Five of the patients, while slightly higher in non-language than in language performances, are so generally deteriorated that they never reach the lower quartiles of the normal group in any of the work estimated. The next two patients, No. 3 and No. 12, reach the lower quartiles in one or two non-language performances, but are never high enough to reach the medians. The remaining patients not only reach the lower quartiles in a larger number of performances, but give some really satisfactory responses which fall above the medians. The two highest, No. 19 and No. 27, surpassed the upper quartiles of the normal group in 28 and 43 per cent respectively of the non-language performance. It is not possible, of course, to say even of these two patients that they duplicate their original levels, for there are no means of determining original levels. Both patients might have been expected to do well on non-language performances: the one had been a successful mechanic and the other, after a number of years as a sailor, had begun to work as a mechanic. The important fact is that any deterioration must be slight in these two cases, for the majority of non-language performances remain above the medians of the normal group, and many remain above the upper quartiles. These two cases are not in a different class

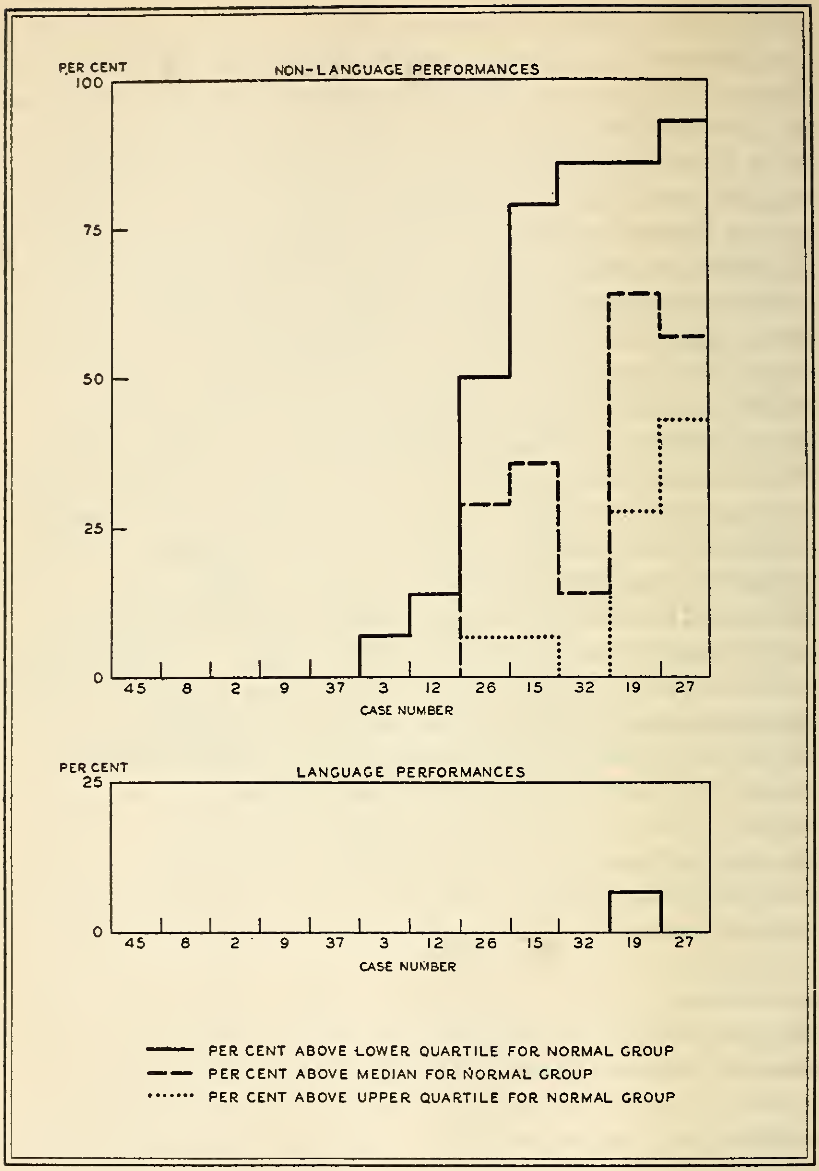


Figure 12. Performances of 12 expressive-receptive patients in relation to the performances of the normal group

from the others. The two below them, one of which is reported in Section 3, resemble them in many ways. This second pair would both have reached higher levels in many responses had not each been handicapped by the enforced use of the left hand. As a matter of fact, the scale seems to be a rather continuous one, with the patients at one end falling below the poorest normals in all performances and those toward the other end attaining progressively higher levels in relation to the normal group on an increasingly greater percentage of the non-language work.

The condition shown by the non-language performances, with the range from extremely poor to extremely good work, is also the condition which appears from observation of the patient's practical and social behavior under natural conditions. Habits of everyday living, however, often remain at a slightly higher level than that indicated by the language, or more significantly, by the non-language tests. They may remain when the patient has deteriorated to levels below those at which the habits would be expected to become possible in the normal course of development. The persistence of habits of eating, dressing, and so forth, is of course just the opposite of the condition in cases where there are apraxic phenomena and where the patient is unable to carry through many familiar and more or less automatic acts. With social as with practical behavior there are different degrees of deterioration, but usually less deterioration in any clear-cut case of aphasia than that indicated by the intelligence tests, whether language or non-language. The uncomplicated cases of aphasia, even when the disorder is severe and extensive as it is in the case of No. 37, whose record follows, are thus sharply contrasted with cases of general deterioration and confusion such as the senile or arteriosclerotic dementias.

2. A SEVERE AND EXTENSIVE DISORDER: CASE NO. 37

The patients at the lower end of the scale, who were so limited in all language and non-language responses, nevertheless differed somewhat in specific points, notably, in the number of words or phrases produced, the use of more or less stereotyped sound combinations, the extent of the understanding, and the quality of the non-language performances. Typical conditions are well illustrated by No. 37.

No. 37. *A case of severe disorder of the expressive-receptive type in which* *all language and non-language performances were extremely low. The lesion probably resulted from a thrombosis of the left middle cerebral artery, implicating the central, parietal, and temporal convolutions.*

Male, Negro, 48; day laborer; education uncertain; probably right handed.

Psychological Summary

The aphasia was extremely severe; affecting both expressive and receptive processes. Speech was restricted to a few syllables compounded of a limited number of speech sounds, and writing was an illegible scribble in which few letters were distinguishable. Satisfactory responses to spoken language were rare and there were no evidences of reading. Non-language performances, although they approached the normal levels more nearly than the language, were still very low. On the whole, the deterioration was severe and extensive.

At the same time the patient had not regressed in everyday behavior and social relationships as he had in other activities. He was easy to take care of in the ward; he could feed himself with the left hand and propel his own chair. He cooperated to the best of his ability on the tests, was pleased at the attention he received, attempted social greetings on seeing the examiner and on leaving, and was generally cheerful and friendly.

Neurological Summary

Seven years before admission to the Philadelphia General Hospital the patient was supposed to have sustained a blow on the left temple and to have been removed to a hospital. He recovered in about a month. Six months before observation there was loss of memory for five hours with severe pains in the head, and three days before some twitching of the face, which was drawn to the right side. A day later he became weak on the whole right side and the following day, when admitted, there was a complete flaccid paralysis of the right side with increased reflexes and Babinski. The tongue deviated to the right and the right soft palate was paralyzed. He was also extremely aphasic.

When examined a week later he had a marked diminution of pain sensation over the right side, but he was not clear enough mentally to be tested for other types of sensation. In the beginning of the second month he developed convulsive seizures which have persisted. His hemiplegia was at first flaccid and later became spastic with the usual increase of reflexes and Babinski. Eye examination showed that the pupils were unequal but reacted to light, and the discs showed an arteriosclerosis. The blood and spinal fluid examinations were negative.

The site and nature of the lesion remain in doubt. A brain tumor was suspected but no confirmatory evidence was available. After considerable observation the conclusion was reached that he had a thrombosis of the left middle cerebral artery, the lesion implicating the motor, sensory, and temporal convolutions.

Psychological Report

SPEAKING. *Spontaneous speech* was almost entirely limited to syllables which were not stereotyped in form or in order, but usually contained an "s" sound. These were uttered frequently and easily in response to questions and were inflected as if they were true speech. Asked how long he had been in the hospital, for instance, the patient said: "Oh . . say . . . oh . . say . . sh . . see . . seeon." Occasionally he could use "yes" or "no" correctly in his answers.

Reactive speech more extensive than the spontaneous speech was never observed.

No. 37 could, however, produce more word sounds, and even a number of correct words, in *automatic word series*. Started on "one-two," he counted as follows: "Sue . . sooe . . three . . th . . four . . five . . six . . six . . six . . seben . . seben . . six . . seben . . . esses . . . ." He could repeat "eight," but he could not go beyond that. In giving the names of the days of the week he required 35 seconds for the following response: "Yes . . . say . . thursday . . seah . . say . . two . . see . . tea . . thursday . . suday . . fursday . . sedday . . ."

NAMING. He could not name objects or colors; each attempt consisted of one or two of the "say-see-essay" syllables and never resembled the true name. Neither could he select objects or colors according to the oral or printed names given him.

REPEATING. In attempting to repeat he again uttered some of the "say-see-essay" syllables. Only once or twice did he respond correctly and then to the very familiar words of automatic speech: he repeated the word "no," he repeated "hello" as "hello-sh-see-say," and "good-bye" as "good-say-see." His repetitions, like his spontaneous utterances, were characterized by natural voice inflection.

UNDERSTANDING SPOKEN LANGUAGE. His understanding was extremely limited; he responded correctly to very few questions, and these related closely to himself. He had no success with any of the test situations unless they were presented with gesture and demonstration.

Reading. No. 37 was unable to pronounce any printed letter or word. He could not name block letters nor select them to oral command.

Writing. He wrote an illegible scribble in which very few letters, chiefly "e," "l," "t," "i" and "r," were distinguishable. His spontaneous writing and his copying were equally illegible. In writing or copying his name only the first letter, "R," was distinguishable.

Non-language performances. Working with his left hand, the patient was able to complete all but one of the *form- and picture-boards* of the Shorter Pintner Performance Scale, but his responses were in every case quantitatively and qualitatively below those of the poorest normal. His placements were random, particularly on the picture tests, and his successes the result of repeated trial and error.

In tracing the *Porteus Mazes,* he made many errors, but was slightly above the level of the poorest normal. Thus his performance here was the highest of all those studied.

Special studies for agnosia and apraxia. Since the non-language as well as the language work was so seriously affected in this case, it is worth while to report the results of studies of those performances likely to be disturbed in the various forms of agnosia or apraxia.

The patient's recognition of non-speech sounds was apparently good. On the test of sound recognition, he could imitate many of the sounds made behind a screen, picking up the bell from the table, for example, and ringing it, or rattling a matchbox. He did as well as could be expected in view of the great deterioration in mental functioning. Although he made many mistakes in matching different geometrical forms (Form Discrimination, Stanford Binet, Year IV), he was able to match objects and almost always able to match colors correctly. He clearly recognized the objects of his daily experience and he could use these correctly.

Tests for apraxia showed no marked defects; his performances were commensurate with his mental level. He was fairly accurate in imitating movements with the fingers, hand, arm, and leg on the left side, though he could perform very few of these to command. He did less well with movements of the face, but he attempted them purposefully. Lack of teeth made it impossible for him to do more than approximate most of the lip, teeth, and tongue positions set for him. Expressive movements were only fair in testing, and ordinarily his gestures were neither plentiful nor very clear-cut. He handled most objects well. The scissors he used poorly, however, first pressing the points down on paper on the table and cutting only when the paper was raised and put between the points as he held them out. At the same time, with allowance for the right-sided paralysis, he carried through some complicated movements well, for instance, folding letter paper, enclosing it in an envelope, sealing the envelope, and stamping it in the correct corner.

The series of tests of auditory and visual perception and of the performance of simple movements and more complicated automatic movements gave results far from the normal, but comprehensible on the basis of the severe and extensive mental deterioration. There were no specific defects in these fields, and some few of the responses here, like some of the non-language performances described above, indicated levels of intelligent behavior considerably higher than those of any of the language responses.

3. A SEVERE DISORDER IN WHICH ALL LANGUAGE PERFORMANCES ARE EXTREMELY LIMITED, BUT MANY NON-LANGUAGE PERFORMANCES SATISFACTORY: CASE NO. 15

No. 15 is important as a representative of the middle ranges of the scale illustrated in Figure 12, page 280. In his case all language responses were just about as defective as those of the patients below him in the scale, but many non-language performances were adequate or even superior.

No. 15. *A case of expressive-receptive disorder in which language performances were extremely low and non-language performances relatively high. The lesion probably resulted from a thrombosis of the left middle cerebral artery implicating the central and temporal convolutions.*

Male, white, 44; truck-driver; grammar-school education; right handed.

Psychological Summary

The aphasia was extremely severe, affecting both expressive and receptive processes. The patient rarely attempted any speech response and never produced more than one or two monosyllables or a short, unintelligible combination of speech sounds. He was unable to write anything but his name and the number series to 10. He understood few questions, however simple, but he was quick to respond to gesture and the cues which he grasped from the concrete situation. He recognized a few words in print. According to hospital records, his condition had apparently been like this during the whole period of five years since the attack. No changes were observed during the nine months of study.

While none of the language responses were up to those of the poorest of the normals, all of the patient's non-language performances were within normal ranges, and 36 per cent of them reached the medians of the normal group. Figure 13 (page 286) shows the relative superiority of the non-language performances.[2] The patient achieved these results in spite of the handicap from the paralysis of his preferred hand. His good non-language performances demonstrated a level of intelligent behavior above that typical for the normal group. His earlier occupation as a truck-driver probably indicated good original ability in mechanical fields, but in occupational and educational status he was essentially comparable to the medians of the normal group.

No. 15 was often unwilling to cooperate on the language tests, and his reaction was a natural one since he was undoubtedly being forced to attempt work he could not handle. He was

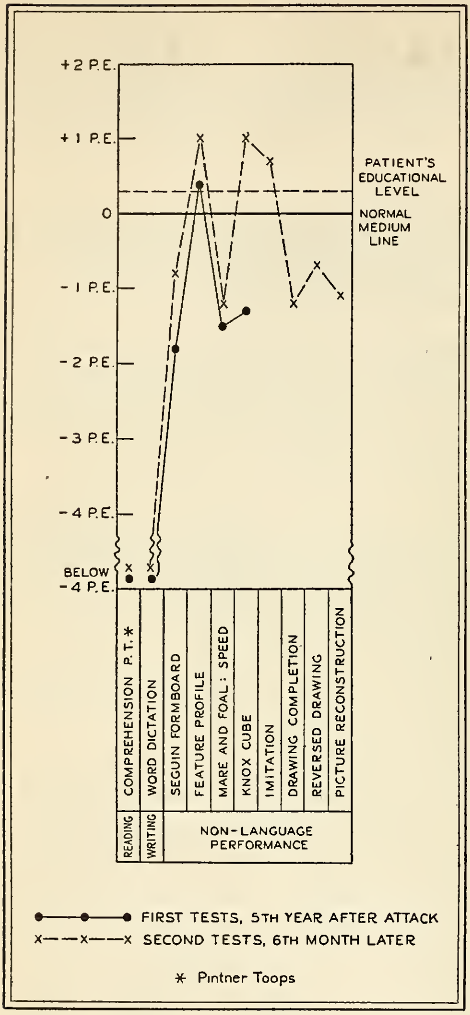


Figure 13. Successive performance levels: Case No. 15, expressive-receptive

always interested in non-language tests, and on these he worked well. His own opinion of his success or failure, as indicated by gesture and facial expression, was usually a correct one. The patient was accustomed to work in the occupational therapy shop and he enjoyed this. He naturally had little social relationship with the men in the ward, and they may have been somewhat wary of him because he was easily angered, and often bad-tempered. On the whole, however, his companions thought him a "sensible fellow" and easily distinguished between his behavior and that of other "speechless" patients who suffered more general deterioration.

---

[2] The graph does not represent a situation so striking as that which actually existed for two reasons. First, language performances were all so far below the normal distribution that they cannot really be expressed in terms of the normal variability. Consequently their inferiority has simply been indicated by placing a reading-comprehension and a dictation test below —4 P.E.; the patient could not understand any one of the directions of the Pintner Toops Test, nor could he write any word of the Morrison McCall Spelling Scale. Second, the non-language performances represented are only those for which fair distributions were obtained from the normal group so that variability in terms of the normal P.E. could be calculated with some justification. This eliminates a number of the patient's scores—chiefly the qualitative scores on the formboards—which were above the normal medians.

Neurological Summary

The patient was a heavy drinker and had been on a "spree" for a week before the onset of the attack, which occurred when he was 39 years old. On arising from bed the day before admission to the Philadelphia General Hospital, he was unable to move the right side. He was unconscious for 16 hours, after which he could not talk at all.

Examination showed irregular pupils, weakness of the right corner of the mouth, protrusion of the tongue to the right, complete flaccid paralysis of the right arm and leg with absent reflexes, but a Babinski was present. Blood pressure was low, 114/80.

Gradually the flaccidity disappeared and was replaced by a moderate spasticity with increased reflexes. Sensation was normal. When the psychological examination was begun, about five years after the onset of his attack, he presented about the same neurological symptoms. Ten months after the psychological examination was begun the patient died of post-operative pneumonia following a posterior gastro-enterostomy. No autopsy was obtained.

His lesion was probably thrombotic, the result of an old syphilitic infection which he admitted, the lesion being located largely in the motor area.

Psychological Report

SPEAKING. During the whole period of observation the patient's *spontaneous speech* was limited to a few monosyllables or short combinations of speech sounds. "What" and "no" were the only words he used more than once or twice. Unless urged to talk, he rarely made any speech sound beyond a sort of grunt. He communicated to some extent by fairly satisfactory descriptive gestures. He could indicate lengths of time and amounts of money by opening and closing his hand to signify five and holding up the necessary number of fingers beyond five or the multiple of five.

Reactive speech was apparently no more extensive than spontaneous speech. The patient's only greeting was a sort of grunt. According to report, he was able to swear; but the examiner never heard him do so, even when he became very angry at being forced to write and began to howl and wheel his chair away.

He could not say any *automatic word series,* but he could write the number series "1 2 3 4 5 6 7 8 9 0." Shown the block letter "A," he said "a, b, o, i," and could not go any further. When asked to arrange the block letters after "A," he placed only "B D G," but at the same time he went over the whole pile of letters and turned each in its proper direction.

Naming. No. 15 could select some objects to oral command; he did less well in selecting from the printed name. He usually produced only an unintelligible sound when asked to name an object, but several times it was obvious that he was trying for the correct name. His nearest approaches were "wass" for "watch" and "pie" for "pencil."

Repeating. The patient once or twice repeated "oh" and "no," but he never repeated any other words or speech sounds.

Understanding spoken language. The patient understood a few simple questions and directions, but he was not always able, for example, to point to his ear, to his eye, and so forth. He responded quickly if he could get the cues from the situation or from gesture; he had no trouble following the directions for the non-language tests.

Reading. No. 15 recognized only a few familiar words in print. He was never able to show that he understood the meaning of any sentences, however simple.

Writing. With his left hand, the patient could write his first and last name. He always wrote the first name in abbreviated form "Geo," and he sometimes began this wrongly, writing "Go" and correcting spontaneously. His only other written response at any time was the number series 1 through 9 or separate numbers.

He was usually unwilling to attempt to copy words from print, but he did copy a few correctly.

Arithmetic. No. 15 would not attempt any printed arithmetic computations or problems. By gesture he was able to demonstrate the value of different coins and different amounts of money up to twenty-five cents.

Non-language performances. No. 15 had apparently always been a right-handed man. During his five years of hospitalization, he had become fairly skillful in the use of his left hand in eating, striking matches, propelling his chair, and dressing, and he was doing successful work in weaving in the occupational therapy shop. Nevertheless he was of course handicapped on the non-language tests by the enforced use of his left hand; he used the right only as a support for the object he was manipulating.

Each of his non-language performances fell within the range of the normal performances on that test; thus none were so low as his language responses, which were outside the normal range altogether. The various non-language performances were of different levels:

79 per cent were above the lower quartiles for the normal group
36 per cent were above the medians for the normal group
7 per cent were above the upper quartiles for the normal group

No. 15 filled in the *formboards* of the Shorter Pintner Performance Scale in a purposive fashion with few wasted movements. His qualitative scores were all above the medians for the normal group; he worked slowly, however, and was almost always below the medians in time scores.

On the *Digit-Symbol Substitution Tests,* where he had to write in the digits corresponding to given symbols, he was so slow that he fell below the lower quartiles of the normal group.[3]

No. 15 at first did poorly on a Knox Cube Test, but his second performance was better, and on the similar *Imitation Test* of the Pintner Non-Language Scale he was above the upper quartile of the normal group. He reproduced the complicated patterns with ease and certainty.

His responses on the *Picture and Drawing Completion Tests* were particularly interesting, for they represented the only performances falling below the lower quartiles of the normal group which could not be accounted for on the basis of his retardation. It seemed evident that he experienced real difficulty with these tests, perhaps because of their more abstract content. Sometimes he failed altogether to find the missing part; he could not, for instance, complete the picture of the foot with only four toes. Some of his other failures were actual errors which resulted from his inadequate comprehension of the situation. On the Picture Completion Test he added the "curtained window" instead of the "broken window" in spite of the fact that pieces of broken glass were pictured under the window.

He was given the *Stenquist Mechanical Aptitudes Test* to see how well he could manipulate types of material which must earlier have been familiar to him. He worked with the various mechanical devices with his left hand, supporting them with his right, and in view of this handicap he did surprisingly well. His score was equivalent to the 44 percentile of army men on whom the norms of the test were established. He naturally did best when he did not have to press the first part in place while he arranged a second but could simply lay the parts together one after the other. When he tried to assemble anything so complicated as the bicycle bell, his manual handicap was particularly serious because he could not try out tentative steps and so work his way toward a solution. He finally pushed the inner parts of the bell aside, placed the top on the base, and indicated by gesture that when the thumb-screw was pressed, a sound should be heard.

---

[3] A certain amount of his retardation obviously depended on his manual handicap. With the idea of determining whether marked retardation was to be found in simple processes, a reaction time study was arranged. By means of the Marietta Reaction Time Apparatus four series of 35 reactions and a fifth series of 50 reactions were made with an interval of a week between each series. The stimulus was auditory, a buzzing sound, and the patient pressed the key with the left forefinger. The instructions had of course to be communicated by demonstration so that no distinction between "motor" and "sensory" reactions could be made. The patient's average time for the last four series of 155 reactions was 140.42 sigma with a standard deviation of 39.24. The average was thus within normal limits; it was high for a motor response but low for a sensory. The variability was much greater than the normal, and greater than that of any of the other patients, aphasic or normal, tested on the same apparatus.

4. A DISORDER IN WHICH LANGUAGE PERFORMANCES ARE LIMITED AND NON-LANGUAGE PERFORMANCES HIGH: CASE NO. 27

In the first case reported as an example of the expressive-receptive disorders, both language and non-language performances were seriously limited; in the second case, language responses of all types were still extremely limited while many non-language performances were satisfactory. A third case, which will now be reported to complete the picture, showed a slightly less extensive language disturbance and a high level of non-language work.

No. 27. *A case of expressive-receptive disorder in which non-language performances were high. The lesion resulted from a depressed fracture causing a softening of the left parieto-temporal area.*

Male, white, 31; sailor, but shortly before the accident had begun to work as a mechanic; grammar-school education; right handed.

Psychological Summary

The aphasia was severe, affecting both expressive and receptive processes. When first examined ten months after the motorcycle accident and four months after the subtemporal decompression, the patient could make a number of speech sounds, but he could use only one word or phrase, "Attaboy!" Although he occasionally understood separate words or simple questions, his grasp of spoken language was exceedingly limited. He understood considerably more from reading and seldom failed with familiar words or short sentences. Moreover, his expression in writing was far superior to that in speaking, and he managed to communicate by writing single words, or an abbreviated phrase, and then supplementing these by descriptive gestures. On the whole, his various responses made it evident that he had a far greater use of language than his limited speech and understanding of speech would indicate.

In relation to the normal group the highest of his responses directly involving language terms was on the printed arithmetic computations. His non-language performances were still higher, 57 per cent of them exceeding the medians of the normal group.[4] They were in general accomplished with ease and dispatch—further evidences of the patient's ability in this work. The relative superiority of the non-language performances shows very clearly in Figure 14, page 292, where the patient's scores are represented in terms of the variability of the normal group.

The first examination was continued for six weeks and ended a week after the exploratory operation of the left temporal lobe. Post-operative studies revealed little change in the patient's language responses; he was able to use a few words in speaking as he had not done at first, but he had gradually acquired these during the previous weeks of study.

A second examination made two months later when the patient was readmitted to the hospital for observation showed that improvement had taken place in all language processes. (Figure 14.) A third examination on the next admission four months later and eighteen months after the accident revealed further improvement in speaking. During the eight months since the first examination the patient's speech had progressed from a few speech sounds and one invariable phrase to a limited speech which was nevertheless some true means of expression. It was still possible only through great effort, however, and it was characterized by difficulty in word-formation and a fragmentary and incomplete type of expression. With the more satisfactory speaking at the time of the second and third examinations, there was improvement in the responses on oral reading and language intelligence tests. There were, however, no further notable changes.

No. 27 cooperated well during each examination. He was well oriented. He was interested in looking at pictures and at baseball scores in the daily newspapers. Until the last examination, eighteen months after the accident, he was fairly cheerful, fond of joking with the nurses and attendants, and apparently normal in his social relationships. His insight into his con-

---

[4] This percentage is calculated on the basis of 14 non-language performances, as described in connection with Figure 12.

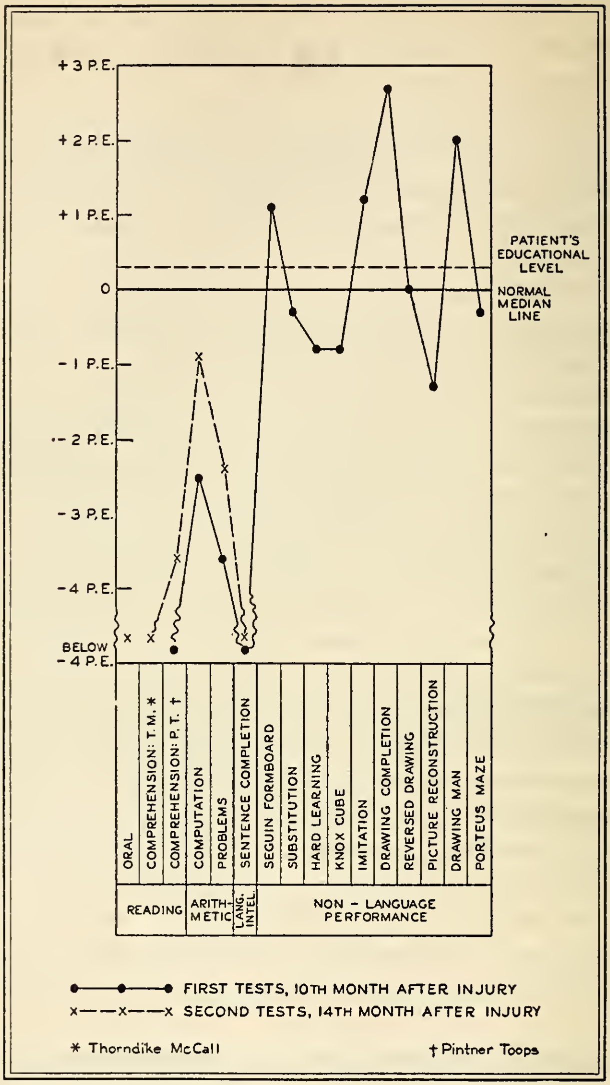


Figure 14. Performance levels: Case No. 27, expressive-receptive

dition was good, and at the time of the last examination he was greatly discouraged. When he was discouraged, he was sometimes irritable and difficult to manage.

Neurological Summary

In August, 1929, the patient was injured in a motorcycle accident and suffered a fractured skull which caused increase of intracranial pressure and choked disc, with dizziness, impairment of vision, and some difficulty in speech. About six months later a subtemporal decompression was done and a hemorrhage and laceration of the brain tissue were found over the left side of the brain. About a week later erysipelas developed in the area of the operation. On recovery from this it was noticed that the speech disturbance was quite marked.

The patient was then removed to the Naval Hospital and from there he was sent to the University Hospital.

Examination about ten months after the accident showed a slight paresis of the right side, the face being more involved than the limbs. There was some disturbance of sensation of an indefinite character over the whole right side and a marked aphasia. Ocular examination revealed only an enlargement of the blind spots, the fundi being normal. An encephalogram demonstrated a slight midline shift to the left with an accumulation of air over the parietal regions, possibly more on the right than the left. Spinal fluid pressure was 130 mm. of water. While under observation he developed a generalized convulsion.

Operation was performed by Dr. Frazier and demonstrated an area of degeneration of the posterior part of the left temporal lobe. On discharge from the hospital the neurological symptoms were practically the same.

Psychological studies were made during his two months' admission to the hospital.

He was readmitted two months later for about a week, at which time his neurological symptoms were about the same. His convulsions had persisted. He was again readmitted three months later and in addition to his early symptoms he had temporary paralysis of the left arm following each convulsive attack. Examination did not show any different symptomatology.

Following this, he has been under observation in the clinic with no change in symptoms.

Undoubtedly the symptoms were the result of a traumatic softening of the left brain, mostly in the parieto-temporal area.

This case was very interesting and is similar to other traumatic cases in that while the neurological symptoms were very mild, consisting only of a moderate right hemiparesis with some sensory disturbances, with later some convulsions, the aphasic phenomena were very severe. This and other similar cases would seem to indicate that in some traumatic cases, at least, the degree of aphasic disturbances gives a better indication of the extent of the lesion than the neurological symptoms.

Psychological Report

Speaking. At the time of the first examination, *spontaneous speech* was scant and accompanied by great effort. "Atta-boy" was the only word or phrase used freely from the beginning, but during the six weeks of study the patient began to use a few other words: "No," "yeah," and "shoore." He once or twice said "I-oh-no" to indicate his inability to respond. For the rest, he could make only a few speech sounds, chiefly "oh," "vee," "bee," "tee."

According to reports, his *reactive speech* was more extensive: he swore a good deal while in pain.

He was no more able to articulate word-sounds in *automatic word series* than in spontaneous speech.

Naming. The patient could not name objects orally, but he could write many names (see under Writing). He could almost always pick out the common objects of Head's Test to oral command, but he made errors if the group were larger and more varied, and he always made errors in choosing colors. He was more successful in choosing objects or colors from the printed names.

Repeating. No. 27 could not repeat words or phrases, except for "Atta-boy!" He could not even break up this phrase and repeat "boy" separately; when he tried, the whole phrase came out as usual. He succeeded in repeating some speech sounds, notably "oh," "ah," "ai," "vee," but failed with many others, saying, for instance, "bee" for "a," "vee" for "ee," "bay" for "no."

Understanding spoken language. No. 27 could understand some simple questions, particularly if they related to himself or his affairs, but in general his understanding of spoken language was so slight that everyone who wished to communicate with him did so either by gesture, which he understood well, or by written questions or directions.

Reading. In *oral reading,* No. 27 was no more successful than in any performance requiring the articulation of speech sounds. Tests of *reading comprehension,* however, showed that he understood printed material far better than he understood spoken language and almost never failed on single common words or sentences constructed of these (Gates Word Recognition and Word, Phrase, and Sentence Reading Tests). On tests of paragraph reading, however, he did less well and fell among the poorest of the literate normals.

Writing. *Spontaneous writing* was the patient's method of communicating with others; he usually wrote no more than one or two words and supplemented these by effective gesture. When he occasionally attempted to write sentences, they were incomplete. The following record was his best performance at this time: "I want operation soon I think Dr. —— operation talk again."

He could write numbers and the names of the days of the week *in series* correctly, but he made mistakes in writing the names of the months of the year and the alphabet.

He could *write names* of many objects which he could not attempt to pronounce.[5] Frequently, however, the names were misspelled. He wrote "knive" for "knife," "macket" for "matches," "bloak" for "black," "goves" for "gloves." When he misspelled a word he would usually show his dissatisfaction with it and would return to it to make changes. His difficulty lay not in confusing the word as a whole with other words but in grasping its formation. In a few instances, his error in forming the word consisted of a clear reversal: he wrote, for instance, "pot" for "top," "Lansacter" for "Lancaster," and "cat wild" for "wildcat."

He could occasionally *write to dictation* words which he could not write spontaneously, but on the whole he was not much better at one performance than the other. In writing short sentences to dictation, he was usually unable

---

[5] Several studies of writing names of objects or pictures were made for the purpose of determining variations in performance from day to day. The results showed that there was little variation. For example, in one experiment made during the first month of study, the patient tried to write the names of 15 animals, pictures of which were presented in set order. When he failed completely, the printed name was shown him for 30 seconds. This demonstration of the printed name was undesirable from the point of view of the study of variability, but it was introduced to make the experiment of greater interest to the patient.

Picture	*Responses on first day*	*Responses 2 days later*	*Responses 2 more days later*
1. Dog	+	god	+
2. Rabbit	ribb	rar	rirr
3. Horse	+	+	+
4. Lion	+	+	+
5. Monkey	—	doney	monday
6. Squirrel	—	sqq	sq
7. Elephant	—	epihant	ep-hanp
8. Giraffe	gigg	gigg	gigg
9. Buffalo	—	bu	bof
10. Camel	+	+	+
11. Bear	+	+	+
12. Wolf	—	walf	wolf
13. Goat	goot	+	+
14. Donkey	dondey	doney	doney
15. Cat	+	+	+

to reproduce more than one word, and this probably represented the only word he had grasped from the dictated sentence.

The patient could always *copy* from print into script easily and with very few errors.

Arithmetic. No. 27 fell in the lowest quartile of the normal group on tests of printed *arithmetic computations,* but he nevertheless approached the normal more closely in this performance than in any other performance directly dependent upon language symbols (Stanford Achievement Computation Test).

Apparently because of his difficulty in reading them, he was relatively less successful with printed *arithmetic problems* (Stanford Achievement Reasoning Test).

Performances on language intelligence tests. By means of written responses to the words of the *Opposites Test,* No. 27 showed that he could give some correct responses, but only about as many as the poorest of the normal group. It was clear, however, that the number of correct responses was a measure of his success in putting his understanding of the "opposite" into verbal expression, and not of this understanding itself, for he could often indicate his meaning by gesture when he could not express it. After reading the stimulus word "straight" for example, he made a motion of drawing a straight line and pointed to the word, and then made a motion of drawing a very crooked line.

On the *Sentence Completion Test,* he likewise had some success but did not reach the level of the poorest of the normal group.

Non-language performances. The patient's non-language performances were clearly superior to those of the normal group:

93 per cent of the non-language performances reached or exceeded the lower quartiles of the normal group
57 per cent exceeded the medians of the normal group
43 per cent exceeded the upper quartiles of the normal group

The patient filled in the *formboards* of the Shorter Pintner Performance Scale quickly and without unnecessary moves; his scores for both quality and rate were superior to the upper quartiles of the normal group.

He did not work rapidly on the *Digit-Symbol Substitution Tests* and fell slightly below the medians of the normal group on these.

On one *imitation test,* the Knox Cube, his score was below the median for the normal group, but in tracing the similar patterns of the Imitation Test of the Pintner Non-Language Scale, he did so well that he was above the upper quartile.

He solved the *Picture Completion Test* with a score above the median of the normal group, and far surpassed the normal on the *Drawing Completion Test* of the Pintner Non-Language Scale.

He drew a *picture of a man* which was superior to the median of the normal drawings in score on the Goodenough Scale. This drawing, and others which he did from time to time, showed no great artistic merit, but they were adequate representations, well proportioned, accurate, and furthermore drawn with great facility.

In tracing the *Porteus Mazes,* he got through the easy mazes successfully and rapidly but failed on several of the more difficult mazes, so that his total score was slightly below the median of the normal group. He wanted to trace the difficult mazes in the air first, trying a number of solutions; he was not willing to draw the path slowly step by step with the pencil. His failures seemed to depend on inability to work slowly, with sufficient "foresight," rather than on inadequate visual analysis of the mazes.

5. SUMMARY

The patients of the expressive-receptive group are set apart from the others by their serious limitations in all language performances. In some few cases one means of expression or one receptive process is more satisfactory than the other, but on the whole all language processes are so defective that no distinction can be made between the expressive and the receptive.

The patients differ greatly, however, in the levels of their non-language performances. These differences become clear when the levels are represented in relation to those of the normal group (Figure 12, page 280). The patients at the lower end of the scale fail to reach the lower quartiles of the normal scores in any performance. Their status has been illustrated by the record of Case No. 37; this patient shows extensive deterioration but, as in most uncomplicated cases of aphasia, much of his practical and social behavior remains at slightly higher levels than his responses to language or non-language tests would indicate. The patients in the middle and upper ranges of the scale show less extensive deterioration. Those in the middle exceed the lower quartiles or the medians of the normal group in some few performances. No. 15 is a case in point; his record, quoted in Section 3, is an important one because much of his work on non-language tests indicates a high intellectual level when all his language responses are extremely limited. The patients at the upper end of the scale, the highest of whom is No. 27, reported in Section 4, are less limited in some of their language responses. The discrepancy between their language and non-language behavior, however, remains large because most of the non-language performances exceed the lower quartiles and many exceed the medians and upper quartiles of the normal scores. Even in these cases, since there are no records of ability before the attack, it is impossible to determine whether the high non-language performances nevertheless have suffered a certain amount of deterioration. The important fact, however, remains that they are high enough to show superior intellectual levels in some cases of great language disturbances, and thus to demonstrate what is for practical purposes a specific language disorder.

XI

TYPES OF APHASIA: THE AMNESIC

1. The nature of the amnesic disorder
2. Case No. 7
3. Summary

1. THE NATURE OF THE AMNESIC DISORDER

AMNESIC aphasia is a fairly well-defined syndrome consequent upon a particular type of disintegration in language, and is more clear-cut than either the expressive or the receptive disorders. It consists essentially of a difficulty in evoking words as names for objects, conditions, or qualities. Sometimes this difficulty is so severe that the patient can say very little. His spontaneous speech may be as limited as that of a severe case of expressive aphasia, but it is not limited in the same way. It is fairly well articulated and free of effort in the production of speech sounds, and it usually shows an even greater discrepancy between the propositional expression and the inferior speech responses than does that of the expressive patient. As a result of the difficulty in evoking words as names, the speech in amnesic aphasia consists largely of familiar and colloquial expressions and of emotional and automatic responses. The prominence of the familiar expressions and colloquialisms probably depends on the fact that they are less precise in their significance for the particular situation than true propositional utterances, and that they represent unitary and fairly automatic responses. Slang phrases are sometimes frequent and these seem to be related in part to the familiar expressions which take the place of the more normal formulations, and in part to the responses which arise from the force of emotional excitement. The superiority of automatic responses in amnesic aphasia is often marked. The patient can produce words in automatic or well-learned series which he cannot produce as independent symbols. For example, he may be able to count with perfect ease and yet be unable to tell the number of days in the week. Often he has learned to make use of the type of speech response he can achieve as an aid to the type in which he fails, and so he counts from one up to seven and then gives seven correctly as the number of days in the week.

A response like this shows one of the most outstanding characteristics of the clear-cut amnesic aphasia, the ability to recognize the correct word. Whether he produces it himself or hears it suggested by the examiner, the patient almost always identifies it, repeats it with some satisfaction, but shortly loses it again. The percentage of correct recognitions is far higher for the amnesic patient than it is for the receptive patient who has difficulty in word-finding.

Considered from one point of view amnesic aphasia is a simple disorder. While some cases are less clear-cut than others, most show few errors in articulation or word-formation and few confusions in words or grammatical forms. Furthermore, understanding of spoken language is relatively good and reading comprehension is fair. In short, amnesic aphasia is little complicated by the disturbances characteristic of the expressive or receptive disorders.

From another point of view, however, the disorder is complex, for the central difficulty in evoking words as names is manifested in many forms of language. Speech is extremely hesitant and inadequate, and writing may be even more seriously disturbed. Repetition is limited because the given words cannot be retained for a sufficient time and then reproduced. The difficulties in repeating are the more striking because of the relatively satisfactory understanding of spoken language. It is apparent that the patient often appreciates the significance of a statement when he cannot reproduce the symbols in which it was formulated. Similarly in reading the patient often fails to pronounce words which he may understand well. In the excellent case of amnesic aphasia reported in Section 2, this contrast was especially clear. The patient often could not pronounce a word which he nevertheless understood, and sometimes he could even spell the word aloud correctly without being able to evoke it as a whole.

The amnesic difficulty is marked not only in spontaneous speaking and in naming, but also on language intelligence tests. Indeed these are often the most satisfactory means of demonstrating a disorder which is so slight that it causes comparatively little hesitancy in speaking or naming. Usually the patient falls far below normal in producing words under particular controlling conditions, for example, in giving the "opposite" to a number of stimulus words. On vocabulary tests where he has to define words, his scores are also likely to be poor, not so much because he fails to grasp the words and their meaning as because he cannot express his understanding in verbal terms.

The non-language studies of the amnesic patients of this group were not altogether satisfactory. All the patients were tumor cases, and most of them were difficult to examine on non-language tests because of their motor or sensory disturbances or general weakness. A sufficient amount of data could be collected from four of the five cases, however, to show that non-language performances were at higher levels than the language.

Records of general attitude and behavior are of interest also because of the controversy as to the nature of the amnesic disorder. As in other types of aphasia, it was almost always evident that the patient had no accurate conception of the extent of the disorder. Interests and social attitudes and relationships seemed comparatively little changed. The two boys of the group, No. 42 and No. 47, occupied their time in the hospital much as any normal boys of similar ages.[1] No. 42 is most significant because his aphasia was severe and prolonged, and his serious difficulty in speaking naturally had a great effect on his activities. Nevertheless he was able to amuse himself in many ways. He looked over the pictures in magazines, particularly "movie" magazines; identified many of the movie stars, and was often heard to comment on the pictures when he could not talk propositionally. For example, when he saw a picture of the Empire State Building, he said: "Boy, I'd like to go up there." This patient was reported to have played solitaire well. He asked for backgammon, a game which he had been taught in the hospital just before the aphasia developed, and he set up the game correctly and played fairly well except for his errors in counting.

The persistence of interests is also shown in the case of No. 7. Until the last period when his disorder became very severe, he always followed the baseball news. It is noteworthy that this patient carried on his business for nine months after the first examination, in other words at a time when his aphasia was relatively severe. And while he complained of being unable to remember telephone numbers and the identification numbers for the various lines of his product, he never complained of difficulty with the larger problems, and he had been able to secure several important orders. The actual deterioration which the aphasia caused in his business activity cannot be determined, but it is noteworthy that he was not discharged and gave up work because of his wife's insistence about five months before coming into the hospital for operation.

On the whole, it may be said that the general attitude and behavior of these amnesic patients showed no greater change than in other types of aphasia, and that here, as in other types, marked evidences of deterioration appeared only in the very severe disorders or stages of the disorder.

---

[1] The records for No. 42 and No. 47 are given in Appendix I, pages 560–566.

2. CASE NO. 7

Of the five cases of amnesic aphasia, that of No. 7 is the most important. The disorder is more clear-cut than any of the others. The patient was an intelligent man of good education and he was studied over a period of two years, with detailed examinations both before and after operation. Furthermore, the operative findings are supported by necropsy evidence.

No. 7. *A case of amnesic aphasia of eleven years' duration with a clinical history of sensory Jacksonian convulsions followed by hemiparesis and hemi-disturbances of sensibility resulting from an astrocytoma which implicated almost half of the left cerebral hemisphere.*

Male, white, 35; salesman; two years at high school; right handed.

Psychological Summary

The aphasia was amnesic in type, with hesitations in speaking, word-poverty, difficulty in naming, and characteristic manifestations of the disorder in repeating, reading, writing, and other performances. Psychological examination was first made when the convulsions had been occurring for more than ten years. During this time the patient had experienced increasing difficulty in finding the words he needed to express his thought and had complained of inability to remember numbers. His hesitancy and inadequacy in speaking had been the more noticeable because he had formerly been a rather good extemporaneous speaker and had regularly led Y.M.C.A. meetings in his home town.

A second examination made fourteen months after the first showed that the disorder had become slightly more marked. After the operation which was then performed, further studies were made, and these showed very much more serious aphasia which still exhibited the characteristics of the amnesic disorder.

The patient cooperated well. He could not work steadily, however, because of recurrent sensations in the right face and right hand which were sometimes forerunners of a convulsion. When these passed quickly, as they frequently did, he would return to work after a few minutes. He was always cheerful and more hopeful for his eventual recovery than his condition warranted. He did not realize the severity of his language disorder. His relationships with his family and with the men on the ward were fairly normal even when his speech became extremely limited; they deteriorated perceptibly only when all his symptoms became much more severe three months after operation.

Neurological Summary

At the age of 26, eleven years before he was first studied by us, the patient began to have Jacksonian convulsions involving the tongue, right side of face and arm, and rarely the whole right side; these were followed by temporary weakness. At the time, he was admitted to the University Hospital where he was examined by Dr. Spiller, who was of the opinion that the patient had a neoplasm, basing this upon the history and the presence of increased intracranial pressure. There were no definite neurological symptoms. From that time on, the Jacksonian convulsions persisted, mostly on the right side and occasionally on the left, without loss of consciousness. With the beginning of these attacks he also complained of numbness in the right arm which disappeared for a year and then returned, the numbness spreading from the right arm, to the whole right side, but not including the face. Soon after the onset of the convulsions it was noticed that he did not see so well to the right as he had formerly. This was particularly marked after a rather severe convulsion.

For the first time about four years after the beginning of the convulsions, he began to have aphasic symptoms, which persisted for four days after a convulsion. Later he gradually developed some disturbance in his speech, the character of which is described later.

About nine years after the onset he first began to have loss of power in his right limbs, this being manifested by a dragging of the right leg.

For a year prior to his examination by us his convulsions had increased in frequency. Occasionally the twitching would be confined to the right face; again the head would be deviated to the right, the eyes sometimes to the right and again upwards. Later on the twitching extended from the right face to the right arm and was followed by a weakness of these parts. His convulsions increased so that they occurred about every ten days.

When examined in the Orthopedic Hospital, approximately eleven years after the onset of the symptoms, besides the convulsions on the right side he complained of pain, particularly in the right arm. His aphasic disturbances were then marked, and it was at this time that the first psychological studies were made.

After his admission to the hospital neurological examination showed a weakness in the lower part of the face, but no other motor disturbances with the exception that the right knee and Achilles reflexes were exaggerated. There was no difference in the power of the limbs. The patient had very marked sensory disturbances, however. All forms of sensibility were disturbed on the whole right side of the body. The right upper limb was distinctly ataxic because of a disturbance in muscle sense and there was loss of stereognostic function in the whole right hand, particularly on the ulnar side.

Ocular examination showed that the pupils were irregular and slightly sluggish to light; the rotations were full; there was some nystagmus on extreme rotation. Ophthalmoscopic examination was negative, but there was a right homonymous lower quadrantanopsia. Barany findings were not distinctive. Spinal fluid examination showed a normal pressure, and all the reactions were negative. X-ray of the skull revealed a marked calcification of the vessels on the left side of the brain in the motor parietotemporal area about the region of the optic thalamus.

Further studies at this time showed that the convulsive phenomena were largely sensory. The patient frequently had sensory Jacksonian convulsions in which the pain was most marked in the right hand, arm, shoulder, and right face, and at this time it seemed that both the objective and subjective sensory disturbances in the right hand were mostly present in the ulnar aspect of the whole right upper limb, i.e., of an axial character. Subsequent examinations demonstrated the fact that, while the sensory disturbances first appeared in the two ulnar fingers and were limited to the upper limb and the face, the patient developed a similar disturbance in the outer toes of the right foot and, furthermore, that at the time of our first observation the numbness was present as much in the right foot as in the right upper limb.

From this time on he was under constant observation until his death, which occurred about two years and three months after our first examination.

The weakness which was at first present in the right face gradually extended so that the arm and leg were distinctly implicated, with the usual increase of reflexes and Babinski. The tone on this side was increased. Sensory disturbances were studied intensively. Touch, two-point discrimination, and vibration and muscle sense were reduced over the whole right side. The stereognosis was lost over the whole right hand.

About twelve years after the onset of the symptoms the patient was admitted to the Graduate Hospital where Dr. Grant partially removed an infiltrating calcified glioma. This tumor was an astrocytoma, considerably calcified; it invaded the pre- and post-central gyri and the parietal lobe, and extended inwards and possibly implicated the thalamus.

For a time immediately following the operation the patient had a complete hemiparesis and his aphasia was much more severe. Gradually, however, power returned so that he was in very much the same condition neurologically as before operation. The aphasia improved slightly but continued to be more severe than before operation. His sensory Jacksonian attacks for a time lessened. About three months after the operation all of his symptoms became increasingly marked. He was later admitted to the Philadelphia General Hospital, where his condition gradually became worse and where he died.

A necropsy was obtained and an infiltrating tumor was found in the left cerebral hemisphere which involved the following structures: the first and second temporal convolutions in their entire extent, the third temporal in its posterior portion, the supramarginal and angular gyri, lower half of the pre-central gyrus, the lower two-thirds of the post-central gyrus and the white matter around the inferior and posterior horns of the ventricle. The histological diagnosis was a calcified astrocytoma.

First and Second Psychological Reports

The records of the first examination will not be given in detail for the performances were similar to those of the second examination fourteen months later, but slightly less seriously affected. The deterioration which occurred during this period and again after operation cannot be shown on a graph as it has for most cases, because so many of the patient's scores were far below the lower limit of the normal distributions. A table of raw scores is therefore presented to show the slight deterioration between the first and second examinations, and the further marked deterioration after operation[2] (Table XIII, page 306). A

---

[2] It must be noted that these raw scores cannot be compared from one test to another, nor can it be said of successive scores on the same test that, for example, the record of 12 on the

TABLE XIII

SCORES ON SUCCESSIVE TESTS: CASE NO. 7

TEST	FIRST EXAMINATION, 4 YEARS AFTER ONSET OF FIRST SPEECH SYMPTOMS	SECOND EXAMINATION, 14 MONTHS LATER. PREOPERATIVE	THIRD EXAMINATION, DURING SECOND MONTH AFTER OPERATION
READING			
Oral (Gray Test, Set II, 150 words)			
Time	145″	187″	Could not complete
Errors	14	18	Too many to record
Comprehension (Chapman):			
Score	7	5	Could not attempt
SPELLING			
Word Dictation (Morrison McCall): Score . .		12	2
Oral Spelling (Gates): Score		8	5
ARITHMETIC			
Computations: Score . .	18	13	9
Problems: Score		13	5
LANGUAGE INTELLIGENCE			
Oral Opposites			
Time	165″	180″	Could not attempt
Score	12	7	
Part-Whole			
Time	175″	200″	Could not attempt
Score	7	4	
Sentence Completion: Score	4.7	5.05	Could not attempt
Oral Vocabulary: Score .	28	29	15

comparison of the figures in the first and second columns will show that on the second examination the patient was slower in all timed performances and, with

---

first performance is almost twice as high as the record of 7 on the second. The table of raw scores shows only the fact of lower performances on the second examination and again lower on the third. It cannot indicate the relative degree of deterioration in different performances or the extent of the deterioration.

two exceptions, made lower scores on tests recorded in terms of number of items correct or qualitative score. The two exceptions are language intelligence tests, the Sentence Completion and the Oral Vocabulary, where the performances on the second examination were slightly superior to those on the first. On the third examination all performances which could be attempted showed marked deterioration and many could not be attempted. Scores on non-language tests are not presented in Table XIII because differences in the motor and sensory disturbances at successive periods had to be taken into account in estimating these. On the whole the non-language performances on the second examination were very close to those on the first, while those on the third were considerably lower.

The record which follows is the report of the second examination, made in the two months before operation.

SPEAKING. *Spontaneous speech* was well articulated but hesitant. Conversation was sometimes delayed for many seconds while No. 7 tried to work his way around to the particular word. Meanwhile he made frequent use of a limited number of words and phrases, such as "in fact," "of course," "naturally," which served as "fillers" and "jumping-off" words.

Reactive speech was less disturbed: names, phrases, and sentences often came to him more readily as partial direct responses to some situation than as parts of his more voluntary speech.

Automatic word series could likewise be produced with some ease. Although he gave each series more slowly than the normal individual, it was always easier for him to count, to name the days of the week or the months of the year, or even the letters of the alphabet, than to produce any item of the series independently.

NAMING. The difficulties in word-finding were obvious in naming tests. The patient hesitated in naming the objects and colors of Head's Tests, and several times failed altogether. In naming the objects, his failures were each on the word "matches." The performance here demonstrated two of the characteristics of the naming difficulty: one, that a name once produced is not necessarily reproduced correctly when next it appears; and two, that the patient may remember whether or not he gave the name on an earlier trial when he does not remember the name.

Item in Head's Tests	*Object*	*Response*
4	matches	"I'm terrible; I'll have to come back to that."
9	matches	"ss . . . match . . . at last!"
12	matches	"nap . . . I'm outa luck with that again."

In naming the Kuhlmann Line Drawings, where a greater variety of objects was represented, he corrected two errors spontaneously, and overlooked one, naming the "foot" a "toe."

Repeating. The patient could almost always repeat single words and very short sentences with no difficulty in articulation.

Understanding spoken language. No. 7 responded easily in conversation but he was not normal in following the directions of the Kuhlmann Comprehension Test, Year VIII, the Abelson Geometrical Figures, or Head's Hand, Ear, and Eye Test. In general he was somewhat less able than he had been at the first examination.

Reading. In *oral reading* No. 7 was among the poorest of the literate normals and slightly lower in both speed and accuracy than he had been fourteen months before. He complained that he could read "without saying anything out" and that he knew the word but could not pronounce it. Tests showed that he did understand slightly better than his oral reading would indicate, but both in the rate of his *silent reading* and in his comprehension of the material, he was among the poorest of the normal group. In connection with his decidedly better understanding of spoken language than of reading, his wife's report was significant: she said that he had never wanted to read much to himself, and that if he wanted to "get something" he would give it to her to read aloud to him.

Writing. His right hand was weak but he could still write and print legibly. He was clearly limited in his *spontaneous writing* by the difficulty in evoking words. In attempting to reach the correct word he sometimes tried out wrong words, just as he did in speaking, but always rejected these. Although the final written product contained few errors, it showed a poverty of words and an unnatural simplification. The following letter was his best production at this time:

Jan. 29, 1932.

Dear Miss McBride—

All day it was ("way" written originally and corrected) raining and I could not go out, but some day I will go out. Today I think it will be better. Hoping you can understand this letter

Your truly

No. 7 sometimes tried to write on paper, or to trace with his fingers in the air, words which he could not produce orally, and he was occasionally successful, but on the whole there was little difference between his success in producing words in writing or speaking.

He could write only very simple words *to dictation,* and on spelling tests, whether oral or written, he was among the poorest of the normal group. Some of his errors resulted from his inability to keep the given word in mind clearly and for a long enough time. Unable to spell it immediately, he would repeat it several times and then shift to a word similar in sound. Other errors, when he was able to keep track of the word throughout his attempt, showed that he could not guide his spelling phonetically. A first attempt to spell "built" resulted in "bight." A second attempt a week later resulted in the following response:

> Built . . . built . . . bught. (Wrote "buight.") That isn't right. No, it's . . . bui . . buight. (Again wrote "buight.") That's not right; that *g* in there's wrong; buit, I guess. (Wrote "buiht.")

This response showed besides the inability to guide his spelling by the sound of the word, a tendency to perseveration which was apparent in many of his responses. Whether or not the "ght" represented a contamination from the word "right" was not clear, but "right" was not a part of his oral response to the first attempt. Occasional errors depended upon still another factor, his abnormal adherence to chance associations with the given word, and his inability to free himself from these in spelling the word. In attempting to spell the word "add," for instance, he printed the letters "A D." Printing was easier than writing for him from the motor point of view. He was unable to correct, because, although he said he knew this response was wrong, these letters formed his own initials.

Arithmetic. No. 7 made simple *computations* fairly well, but had trouble with those involving two- or three-place numbers. His failures depended first on various confusions in method, which led him, for instance, to attempt to multiply the short multiplier by the three- or four-place multiplicand instead of vice versa; and, second, on an inability to keep in mind the result of the first computation while he worked on the second. This latter difficulty was the most disastrous; he attempted to overcome it by writing down each number to be carried, and, sometimes, by breaking up the computation into as many parts as possible and working at each part separately on scratch paper. His score for printed arithmetic computations fell among the poorest of the normal scores (Stanford Achievement Computation Test).

His score for printed *arithmetic problems* fell in the lowest quarter of the normal scores (Stanford Achievement Reasoning Test). His complaint as he worked at a very simple problem was illuminating; he said: "It's so simple but I have to use my brain; I shouldn't even have to use it." And it was certainly true that in computations and arithmetic problems, as well as in many other types of activity, the normally more or less automatic responses had been disturbed. Furthermore, the resulting disorders depended not only on the breaks in the automatism, but on the difficulty in compensating for these breaks under conditions of disturbed word-finding, shortened immediate memory span, tendency to perseveration, and abnormal adherence to parts of the situation.

Performances on language intelligence tests. The amnesic difficulty was again obvious here. On *controlled association tests* (Opposites and Part-whole) No. 7 gave about as many correct responses as the poorest of the normal group, in spite of an education superior to theirs, and he required even more time than the poorest of the normals. His responses showed the nature of his difficulties more clearly than on the first examination. In the Opposites Tests there were, aside from complete lack of response, frequent perseverations of an earlier response, associations dependent upon the word-sound, and an increasing tendency to lose the controlling idea "opposite" and to make random comments on the stimulus word. In response to the stimulus word "friend," for instance, he said: "Friend, I have lots of friends." Such comments in response to simple stimulus words were rare among normal persons. No. 7 could make no attempt at the Analogies Test because of his inability to retain the first three words long enough to find a fourth word with the same relation to the third which the second bore to the first.

On the *Sentence Completion Test* he equalled the poorest of the normal group; his slightly greater ease on this test as compared with the controlled association tests probably resulted partly from the fact that the problem did not have to be kept in mind continuously but was fairly evident from the test material as presented; and partly from the fact that the response was determined, not by a single stimulus word, but by a more extensive whole.

The *Stanford Binet Vocabulary Test* was an index of his ability to find words to express his thought rather than of his understanding of word meanings. Scored liberally, his performance would rank among the poorest of the normal group, but even his successful definitions were abnormally indirect and diffuse. The following was a typical example:

> Bonfire . . well, a bonfire . . in fact sometimes we use that in the fall when the trees are all . . in fact we use that . . . in fact lots of times they use a bonfire when . . . in fact when I was a kid I always used a bonfire.

No. 7 usually had no difficulty in grasping and repeating the words of this vocabulary test. In some few cases, however, he missed words. When, for instance, the word "quake" was pronounced, he repeated it as "quick." When "quake" was again pronounced clearly, he repeated it correctly, but slipped back to "quick" in his definition. Shown the word in print, he read it correctly but defined it by saying: "There are some quake doctors around here." In another case, when the word "treasury" was given, he at first repeated the word correctly, but then corrupted it to: "tredges . . . tredge." When the word was repeated again at his request he defined it correctly. These errors seemed to result from a relatively slight perceptive disorder, together with difficulty in the retention and reproduction of verbal material.

Reproduction of verbal material. The patient could repeat only four digits, three letters, two unrelated words, or sentences of five to six syllables. Thus he fell below the poorest normal in all these tasks. In repeating the short story of 82 words after hearing it read three times, he reproduced less than half as many items as the normal person (Auditory Verbal Memory Test). The response showed his slowness and difficulty in finding suitable words:

> There was a sailor . . . . he was . . . . he was, in fact he was out . . (45″) . . . out . . lemme see, the sailor was . . in a bad situation. He

> was there and couldn't find any place . . anything to eat or anything to sleep. He evidently was afraid that at night . . sleeping . . that . . . (90″) the . . . . (Anything else?) Yes, I'm trying to think of one word . . see . . . . lion. He evidently was afraid of the lions. (135″) He also from now on has to try to get something to eat. He needs something to eat; and then he will put out . . . not a sign . . for one of the ships that will eventually pass.

In spite of the word-poverty, it was clear that he not only understood the story but retained more of it than he could express in suitable words. He did not say that the sailor was "shipwrecked in a wild country" but that he was in a "bad situation." On the whole the tests, together with the evidence from his behavior in general, showed that he could reproduce most readily when precise verbal formulations were least essential. It seemed clear that the difficulty in reproducing words depended upon the difficulty in evoking words and was in itself a subordinate phenomenon.

NON-LANGUAGE PERFORMANCES. Because of the weakness of the right hand and the visual defects, performance tests were unsatisfactory. They showed No. 7 to be slower than the medians of the normal group, but his motor and sensory disorders were without doubt factors in his retardation. Qualitatively his performances were also below the normal medians, probably in part because of the visual defects. In spite of the disturbing factors, however, No. 7 approached the normal more nearly in non-language than in language performances.

Third Psychological Report

Immediately after the operation the aphasia was more severe than before but not different in type. Spontaneous speech was more limited and more obviously handicapped by difficulty in evoking words, but was still undisturbed from the motor point of view. Understanding of spoken language was still relatively complete. Continuous observations during the first three months after operation revealed a gradual improvement.

SPEAKING. *Spontaneous speech* two days after the operation was limited, infrequent, and retarded. Without difficulty, however, the patient could make such remarks as "I donno what was the matter with me"; "I feel fine"; "Dr. Weisenburg was here." These statements during the next few weeks were supplemented by many slang phrases and more or less automatic expressions. One week after the operation, for instance, he tried to report the doctor's comment thus: "He just said that according to Hoyle . . . er . . . this thing . . ." (patted his bandage). He used the phrase "according to Hoyle" easily and yet could not explain anything of what the doctor had said about his head. These ready-made expressions continued to be frequent even when some improvement took place. During the three months after the operation, however, the improvement in speaking did not raise him to his pre-operative level.

Words came more easily in *automatic word series* than in spontaneous speech. No. 7 could at first count to fifteen or so and say the names of the days of the week in twenty to thirty seconds. Later he was able to count easily (and also to count with fair accuracy by twos, fives, and tens) and to say the names of the days more rapidly, but he could never say the months or the alphabet correctly.

Naming. Language performances were so severely affected after the operation that the more complicated language tests were obviously too difficult; the simpler naming tests consequently became the more important. The difficulty in evoking words had increased to such a point that the patient named only one or two common objects or familiar colors of ten presented. He was not always able to name the same objects at each trial, but the average number of successful responses remained relatively constant. These averages gradually increased, and towards the end of the three-month period he had made clear progress.

Analysis of the responses of the many trials showed a good deal about the nature of his difficulties. Post-operatively, his language was at first too limited for him to find words to express the use or nature of the object he could not name. He was still almost always able to choose the correct name from a number suggested to him. So severe was the amnesic disorder, however, that even after choosing the correct name from among others and repeating it once or twice, he almost invariably lost it again. Naming an object the second time presented as great a problem as the first naming. In contrast to this very rapid loss of the name was his tendency to give a name which had earlier been correct to several later objects in the series. He would reject these perseverations and then suggest them again, as if they continued to arise in his mind when few other solutions did, and as if they were each time actual possibilities which he could discard only after trying the name aloud.

When he could not name the object but could select the correct name, the question arose as to the extent of his grasp of that name. He was usually particular in selecting that one of the words suggested which was the most exact term for the object. When, for instance, he was asked to name a large pocketbook, he gave these responses:

> . . . I fell down on this all right . . . well, I guess we're outa luck . . . (Is it a *map?*) No . . . (A *trunk?*) No . . . (A *purse?*) . . . Yeah, well, you can use it that way but that isn't . . . that isn't what . . . what's the proper name? . . . (*Money?*) No . . . (*Bag?*) . . . Well, you can call it that . . . (*Pocketbook?*) Yeah!

Although his recognition of the exact name was usually as immediate as in the above example, he occasionally used the name he was seeking in a phrase, apparently without recognizing it. The phrase seemed to come to his mind as a whole, so coherent in itself that the single word for which he was searching had no independent existence. For instance, in one of his attempts to get the name "bed," he responded as follows:

. . . I'm gonna get this . . . (15″) . . . (60″) Well, I guess I'm not . . . (What is it used for?) Why, when you get at night . . . you . . . go to bed . . . when you go to bed . . , that's the only place (95″) . . . *bed!* oh boy! (105″).

In addition to the examples which showed his understanding of the exact significance of the word, there were other less frequent evidences that he knew something of the form, or of the component letters of the word he could not produce. Sometimes he would say the first letter or sound; sometimes he would try, as described above, to write the word or to trace its letters with his fingers in the air. While he was rarely more successful in spelling the word than in saying it, he sometimes produced one or more of its letters. In a few cases he knew enough about the word to be able to tell how many letters it contained.

On the whole, the responses indicated that the lost name had for him at least a vague sphere of meaning, an accessibility such that the word-form could almost always be recognized unless it was a part of some stronger coherent whole, and in addition remnants of facts about the word, such as one or two of its letters or the total number of letters present. This was the prevailing condition when words were to be used as names. They could always be used with more freedom in the more automatic types of response. While the word-poverty, accordingly, did not hold for all types of speech at any time, it was a constant factor of "propositional" speech; the patient was continually handicapped by inadequate tools for thinking. Once, for example, when he was asked the difference between "wood" and "glass," he talked about wood separately and then said that he had forgotten the other word. When "glass" was repeated, he pronounced it with emphasis and said: "Glass! I'm glad you told me that . . . glass!" He seemed to find that the word opened for him a new possibility of thought, or at least added to that already his.

Repeating. The patient still repeated very short sections without difficulty in articulation.

Understanding spoken language. He still understood questions and directions with fair ease. He made few mistakes with oral directions comparable to those which were very difficult for him when presented in printed form.

Reading. Shortly after operation, No. 7 made more errors in choosing objects from the printed name than from the spoken. A month later, when reading tests were made, he could name most single letters, whether capital or lower case. When he failed, he usually had some recognition of the letter. He could not name "u," for instance, but he said "underwear" quickly. (He was in the underwear business.)

Similarly on the Gates Pronunciation Test, where he succeeded on the first trial in pronouncing only six simple words of the first thirty, he was able to recognize many more words than he could utter aloud. Sometimes he suggested a wrong word which was nevertheless in the "sphere" of the correct one. The nature of his problem appeared in the following response. When he first came to the word "son" he could not pronounce it, but showed by several comments that he related it to his boy. Later he went back to the word spontaneously, with the following result:

> *Boy* . . . no, it isn't . . . boy . . . no . . . what my Mother calls me. . . . (What is that?) Boy? . . . no, so . . . *the* . . . no, son . . . the? . . . (How do you spell it?) Son, is it? (Yes) . . . (What do you call it?) Boy, no, not a boy . . . (Is it *daughter?*) No, it's *boy,* or man . . . no . . . (Is it *moon?*) Moon? No, nossir, it's boy . . . it's . . . it's just the same as boy . . . (Is it *nephew?*) No . . . (Is it *father?*) No, the next thing . . . boy, no, I told you that about half a dozen times. Let me see, boy? . . . (Is it *kid?*) No, it's just like a boy or a man . . . 'course not a man . . . wait, I'll tell you . . . (Spell it again.) Son . . . (And again! Fast!) Son . . . son . . . yes . . . son . . . son . . . I usta be one myself, not a boy but a . . . (You have it almost!) It's not mister . . . mis . . . *boy* . . . not boy . . . *son!* Isn't that terrible now!

This and other similar records were particularly interesting because they showed the effect on the reading process of the inability to find words. When the disorder was severe enough, even the printed letters, although they were recognized, might not be sufficient to lead to the word. Its significance, however, might be relatively clear. Under such conditions, it was only natural that the patient had greater success in understanding the printed material than in reading aloud. Actually he was able to recognize almost all the familiar words of the Gates Word Recognition Test. He was more easily confused by sentence and paragraph material than he had been pre-operatively.

WRITING. Two or three months after the operation, No. 7 could write a few words *spontaneously,* words such as "cat," "the," "you," but no complete sentences.

He could also write one or two words *to dictation* correctly, but he usually failed even on simple words. In *oral spelling* he did slightly better, succeeding chiefly when he was able to spell out the letters very rapidly and immediately after the word had been dictated. It was as if the very rapid spelling was a remnant of his old, more automatic performance. The patient himself seemed to appreciate this, for when he had spelled both "catch" and "teach" correctly, he said:

> On all of them if I give them without saying a word . . . in fact, I don't have to think even on that . . . if I'd stop . . . I donno how it is . . .

When he did stop, when he failed to give the letters immediately, he often suggested some letters carried over from a previous word, or lost track of the word. When he lost the word he sometimes slipped over to one in the same sphere. This type of error appeared in the following example:

> (Spell "day.") Day . . . today . . . day . . . (Yes, "day.") day . . . day . . . day . . . to-day-to . . . to . . . toaorro . . . tomorrow . . . tomorrow . . .

Arithmetic. Two months after operation, No. 7 could read numbers up to four places with fair accuracy. When he made a mistake, he corrected it spontaneously by trying several numbers until he found the right one. He could not identify arithmetical signs, either by the name or the significance. On the printed *arithmetic computations* he was slightly lower than he had been before the operation (Stanford Achievement Computation Test). He now had difficulty deciding on the arithmetical process, whether it was indicated by a symbol or by a printed word. He used a counting system to arrive at the correct number, apparently because he could not think of it by name, but could usually recognize it as he counted over the number series. While he could manage the counting fairly well for very simple problems, he could not use it successfully for the more complex, and there he failed altogether.

On the printed *arithmetic problems* he was much lower than he had been before (Stanford Achievement Reasoning Test). He could understand only the simplest of them, and succeeded only with those requiring a single addition or a single subtraction.

Performances on language intelligence tests. Language intelligence tests were now too difficult, but the Stanford Binet Vocabulary was given several times as a means of studying the patient's spoken expression. One month after operation he could indicate the meaning of only half as many words as before operation; in another two months he responded about as well as he had before operation. The definitions were still indirect; for example, his definition of "dungeon" was "If I went in I couldn't see" and his definition of "Mars," "You mean . . . the . . . er . . . another little moon." In spite of the indirect expression, it was often apparent, as in these two examples, that the patient was still in command of much of his former knowledge, that he appreciated far more of the meaning of the word than he could express verbally.

Reproduction of verbal material. After operation, No. 7 was even more limited than before in the reproduction of verbal material. During the first few weeks he could repeat only two digits and one or two short words. A little later he was able to repeat three digits, but never more and never a sentence as long as six or seven syllables.

Fourth Psychological Report: Summary

When the patient's symptoms became more marked about three months after operation, and the aphasia was more severe, he could say only one or two words spontaneously and answered "Yes, yes" to all questions even when he meant "no." He could count up to nine or ten and he could repeat a few words, sometimes with poor articulation. When his speech became a little more extensive and he attempted to name objects, he again had difficulty in articulation and produced some misformed words, like "broad" for "bird." These difficulties, typical of expressive disorders, were new; they had not appeared before the attack. As before, the patient was usually able to select the correct name for an object from among several presented orally. He followed oral directions fairly well. In trying to read aloud, he pronounced only the word "ball." He could indicate his recognition of many printed words by pointing to those which represented given pictures. He could still write a very few words and he could copy single words without error. On the Shorter Pintner Performance Scale he was slower than he had ever been before and the quality of his performance was poorer, so that he ranked among the lowest of the normals on almost all the tests.

During the next seven months occasional observations showed that the only further change consisted in a slight increase of words in spontaneous, and particularly in reactive speech. Only rarely could the patient give a name correctly or pronounce a word which he saw in print. While the disorders in this final period were everywhere more severe, they were substantially the same in nature. Although the patient could use some words and phrases in a more or less automatic fashion, he was almost always unable to produce words as names; he recognized names and understood spoken language fairly well. The only change was the increased difficulty in articulating words and the occasional appearance of misformed words, an indication that there was now an expressive component in the picture.

3. SUMMARY

Amnesic aphasia is a relatively clear-cut disorder which consists essentially of difficulty in evoking words as names for objects, conditions, or qualities. The characteristics of the disorder are illustrated in this chapter by Case No. 7. Speech is hesitant and scanty and contains an abnormally large proportion of ready-made expressions, colloquialisms, and emotional and automatic responses. The central amnesic difficulty is manifested in a variety of forms of language, including naming, repeating, reading, and writing. Understanding is relatively well preserved. Furthermore, the patient almost always recognizes the correct word when he produces it or when it is suggested to him. Non-language performances and observations of behavior show no general deterioration or change commensurate with the changes in various forms of language activity.

XII

THE CASES OF BRAIN TUMOR

1. The nature and location of the lesions
2. Psychological characteristics
3. Summary

1. THE NATURE AND LOCATION OF THE LESIONS

Of the 60 aphasic cases selected for critical analysis, one quarter, or 15, occurred in space-taking lesions. The study of speech disturbances in such conditions is of importance not only because of their relative frequency and their aid in locating the lesion, but because of the information they furnish with regard to the psychological phenomena occurring in rapidly changing pathological states. Moreover, these conditions offer the invaluable opportunity of examining a patient with or without speech disturbances previous to operation, with the probability that some type of aphasia will follow a left-sided cranial operation in a right-handed individual, or vice versa.

From the standpoint of localization, the presence of speech disturbances may aid and in some instances determine the side of the lesion; the absence is of less importance, particularly if judgment as to the existence of aphasia is based on old methods of testing. Experience in this research has shown that aphasia has sometimes been diagnosed where none exists or that the type of speech disturbance has been wrongly diagnosed—as in nineteen of the cases examined—with the additional disadvantage of a suggested cerebral localization where none is really possible.

A summary of the important facts on the type of pathology, the onset of the symptoms and their nature, the operative findings, and the postoperative course is presented for the fifteen tumor cases in Table XIV, facing page 318.

Of the five *expressive* cases, there were distinct aphasic symptoms prior to operation in only two; in neither was the speech disturbance a decisive factor in establishing a diagnosis. In one of these cases, No. 34, in which the aphasic symptoms were more distinct, the diagnosis (calcified tumor of the mesencephalon) was established by means of the x-ray. In all of these cases speech disturbances should have been present if the old ideas of localization are accepted.

In the three *receptive* cases the aphasic symptoms were of distinct value and aided in the diagnosis, and at least in one case, No. 60, in the absence of more decisive symptoms indicated the side of the operation. It is interesting that this patient was left handed but had been trained to use the right for writing and sewing. The lesion was an adenocarcinoma of the left temporal lobe but the most marked disturbances before operation were not in speaking or understanding but in reading and writing. In one of the three cases, No. 58, no operation was permitted; in the other two, examinations were made both before and after operation. In each instance the first examination showed aphasia of the receptive type. Post-operatively, with the exception that the aphasia was more marked, there was little change.

Of the two *expressive-receptive* aphasics, in the first, No. 2, the speech difficulty was not clear-cut before operation, but the reading pace was slower and long words had to be spelled out before they were understood. This was another left-handed patient with a lesion in the left hemisphere. In the second case the aphasic symptoms appeared first and were of distinct help in the diagnosis, although subsequent neurological symptoms indicated the site of the lesion.

The five *amnesic* cases were most interesting because it was only in these tumor cases that this distinctive type of aphasia was found. In three, examinations were made both before and after operation, and in one, No. 7, the aphasia was studied for over a year before operation. In two cases an abscess was found; in the first, No. 42, the abscess was of rather large size in the left central and parietal areas and in the second, No. 47, in the temporal area only. Of the other three cases, in one, No. 7, in which a necropsy was obtained, a large calcified astrocytoma occupied about two-thirds of the left hemisphere. In the others operation revealed a spongioblastoma in the left temporal lobe, No. 17, and an astrocytoma of large size, No. 18, in the temporo-parietal area.

Why these lesions of varying size and character should have developed amnesic aphasia we are at a loss to explain. It is not because of the type of the lesion nor the size, for as pointed out previously, in three the lesion was of a gliomatous character and in two, abscess formation. In at least two, No. 42 and No. 47, the lesions were limited in size. Nor is the period of the

III. L

2

8

IV. A

7

speech disturbances should have been present if the old ideas of localization are accepted.

In the three *receptive* cases the aphasic symptoms were of distinct value and aided in the diagnosis, and at least in one case, No. 60, in the absence of more decisive symptoms indicated the side of the operation. It is interesting that this patient was left handed but had been trained to use the right for writing and sewing. The lesion was an adenocarcinoma of the left temporal lobe but the most marked disturbances before operation were not in speaking or understanding but in reading and writing. In one of the three cases, No. 58, no operation was permitted; in the other two, examinations were made both before and after operation. In each instance the first examination showed aphasia of the receptive type. Post-operatively, with the exception that the aphasia was more marked, there was little change.

Of the two *expressive-receptive* aphasics, in the first, No. 2, the speech difficulty was not clear-cut before operation, but the reading pace was slower and long words had to be spelled out before they were understood. This was another left-handed patient with a lesion in the left hemisphere. In the second case the aphasic symptoms appeared first and were of distinct help in the diagnosis, although subsequent neurological symptoms indicated the site of the lesion.

The five *amnesic* cases were most interesting because it was only in these tumor cases that this distinctive type of aphasia was found. In three, examinations were made both before and after operation, and in one, No. 7, the aphasia was studied for over a year before operation. In two cases an abscess was found; in the first, No. 42, the abscess was of rather large size in the left central and parietal areas and in the second, No. 47, in the temporal area only. Of the other three cases, in one, No. 7, in which a necropsy was obtained, a large calcified astrocytoma occupied about two-thirds of the left hemisphere. In the others operation revealed a spongioblastoma in the left temporal lobe, No. 17, and an astrocytoma of large size, No. 18, in the temporo-parietal area.

Why these lesions of varying size and character should have developed amnesic aphasia we are at a loss to explain. It is not because of the type of the lesion nor the size, for as pointed out previously, in three the lesion was of a gliomatous character and in two, abscess formation. In at least two, No. 42 and No. 47, the lesions were limited in size. Nor is the period of the

TABLE XIV. ANALYSIS OF THE FIFTEEN CASES OF BRAIN TUMOR

CASE NO.	AGE AT FIRST HOSPITAL ADMISSION	HANDEDNESS	TYPE AND LOCATION OF TUMOR	SYMPTOMS BEFORE FIRST OPERATION		NATURE OF OPERATION	SUBSEQUENT COURSE	PSYCHOLOGICAL DISTURBANCES (Data taken from hospital records in parentheses)	
				Duration before first operation	*Nature*			*Pre-operative*	*Post-operative*
I. EXPRESSIVE GROUP									
11	33	R	Spongioblastoma multiforme of L frontal, temporal and parietal lobes (necropsy)	10 years. 7 years. 3 years. On admission.	Struck L side head with baseball; unconscious 10 min. Attacks numbness R side face and shoulder Weakness R arm. Attacks numbness and twitching R neck and shoulder. Possible R facial weakness and weakness R arm. Paresthesias R face, arm, neck, and chest; impaired hearing on R with tinnitus both sides. Headache.	*First.* Removal of portion of tumor in R fronto-parietal area. *Second.* 3½ yrs. later, removal of large portion of tumor under upper part of earlier opening	*Post-operatively.* R hemiparesis and marked aphasia, both of which improved greatly. After 3 yrs. increasing weakness of the R side and aphasia. *Witzelsucht.* *Post-operatively.* Weakness and aphasia decreased rapidly. After a year and a half paralysis and aphasia again marked; death followed 3 mos. later.	(None.) (Marked aphasia; *Witzelsucht* before second operation.)	(Slight amount jocularity; marked aphasia.) Some jocularity. Moderate aphasia of expressive type with difficulty in articulation, some disturbance in the understanding of spoken language and printed material; great difficulty in writing and poor performances on language intelligence tests. Some improvement during 2 weeks after operation.
34	27	R from time he went to school, but originally L.	Probable calcified tumor in region of mesencephalon.	Age 6 to 21. 2 years. On admission.	Dizziness and attacks of fainting. No unconsciousness. History of running L ear Frontal headache accompanied by nausea and vomiting Tremor and slight weakness R hand. Difficulty in speaking and writing. Discharging L ear. X-ray: multiple calcified lesions just to L of mid line, in front of pineal region	Exploratory operation over L temporo-parietal area, revealing nothing but increased quantity of spinal fluid	*Post-operatively.* R hemiparesis and marked aphasia, both of which improved rapidly. *Seven months after operation*, slight R hemiparesis with tremors in arm and leg, other findings as before.	(Difficulty in speaking and in writing which may have aided in the localization.)	Severe aphasia of expressive type with great difficulty in articulation and word formation, disturbances in the understanding of spoken language and printed material. Seven months after operation aphasia very slight.
48	32	R	Meningeal fibroblastoma of L frontal and parietal lobes.	2 years. On admission.	Weakness R arm followed in 2 months by weakness R leg and gradually of whole side. Irritability and emotionalism. Nausea, vomiting, headache, disturbance of vision, tendency to drowsiness, and some staggering on walking Marked hemiparesis with increased reflexes and Babinski. Sensory disturbances on R side, and astereognosis. Spinal pressure increased. Uncinate attacks with olfactory hallucinations. Bilateral choking and concentrically contracted fields with enlarged blind spots.	*First.* Large subcortical tumor in L fronto-parietal exposed. *Second.* Large and well-encapsulated tumor removed, extended from parietal lobe well into frontal and from cortex to base.	*Post-operatively.* Hemiparesis increased and marked aphasia developed. Improvement, with sudden decline after 2 mos. *Post-operatively.* Hemiparesis and marked aphasia with gradual improvement in the latter in the course of a year.	Irritability, emotionality, failing memory and slowness in expressing thought. No definite aphasia symptoms. (Aphasia improved, but was again marked 2 months after first operation and just before second.)	(Marked aphasia.) Severe aphasia of expressive type, complicated by difficulty in evoking words and verbal confusions, and with serious disturbances in receptive functions. Retardation in response; occasional lapses when no response could be elicited; perseveration. Some tendency to foolish laughter.
49	43	L	Glioma of R fronto-temporal area.	9 weeks. On admission.	Headache, dizziness, nausea, vomiting. Weakness L arm and leg. Reflexes bilaterally increased, more on L, bilateral Babinski, and ankle clonus on L. Possible astereognosis of L hand. Spinal fluid under increased pressure. Hyper-somnolence. Complete anosmia. R pupil slightly larger than L. Beginning blurring of both discs. X-ray: pineal shifted downward, backward, and toward L side.	*First.* R temporo-frontal craniotomy with fulgurization of a glioma. *Second.* 1 mo. later: large amount tumor and degenerative tissue removed from same area.	*Post-operatively:* Condition at first satisfactory but within a month headaches returned and patient became progressively weaker. *Post-operatively.* L hemiparesis and complete aphasia, with some improvement in limb motor power and speech within a month.	(Changes in personality; mentally confused, disoriented for time and place, tendency to jocosity. No definite aphasia.) (Very little reaction to any stimulation.)	(Mental condition at first good, but within a month marked degree of mental deterioration.) Emotional. Severe aphasia of expressive type. Speech limited to a few sounds or words; writing very little better. Receptive functions limited but less disturbed than expressive.
51	55	R	Subcortical cyst of L central area, hemangioma.	6 months. 4 months. On admission.	Tingling in R face. Weakness R hand, and then progressive weakness whole R side. Spastic R hemiplegia with increased reflexes, and ankle clonus but no Babinski. Diminution of touch, pain, and heat sensibility in R leg.	L fronto-temporal craniotomy with evacuation of subcortical cyst just above Sylvian fissure in lower part of motor cortex.	*Post-operatively.* R hemiplegia much as before operation but aphasia more severe. Cyst retapped 4 mos. after operation, with slight improvement in her speech. Death occurred 4½ mos. after operation.	(Difficulty in speaking. Aphasic symptoms some help in diagnosis.)	Emotional. Aphasia of expressive type with very inadequate speech. Clear difficulty in evoking words. Receptive functions relatively well preserved. Noticeable perseveration.
II. RECEPTIVE GROUP									
11	14	R	Meningeal fibroblastoma of L parietal and occipital lobes.	1 year 4 months. On admission.	Attacks of unconsciousness about every two weeks. Attacks occurring every week. Intention tremor both hands and weakness R arm; generally hyperactive reflexes with suspicious Babinski on R. Irregular pupils, sluggish to light. R homonymous hemianopsia. X-ray: thinning of the dorsum sellae and posterior clinoid processes.	*First.* L fronto-temporo-parietal craniotomy with plunge for localization of tumor lying in L occipito-parieto-temporal region. *Second:* 3 months later, L occipital craniotomy with removal of large encapsulated meningioma which arose from the angle between the falx and tentorium	*Post-operatively.* Definite R hemiparesis and more severe aphasia, both of which gradually improved until the condition 3 months after operation was about that before operation. *Post-operatively:* Death.	Slight aphasia of predominantly receptive type. Speech somewhat scanty and repetitious. Understanding slightly limited. Writing poorer than speech. Aphasic symptoms of some help in localization. Same as before first operation.	More limited speech, still well articulated. Much greater difficulty than before operation in repeating, understanding, reading, and writing.
58	48	R but has written with L for 5 years.	Suspected tumor of slow growth in L parietal and frontal lobes.	15 years. 10 years. On admission.	Occasional attacks numbness, beginning either in R hand or face. Later: pain in supraorbital region followed by headache. During attacks: drowsiness, inability to talk well, and occasional diplopia. Weakness R hand Definite weakness R face, tongue, palate, and arm but little weakness of leg, and reflexes prompter on R. Touch, pain, temperature, and vibratory sensibility normal in most examinations, but astereognosis occasionally apparent in R hand. Definite ataxia of both upper and lower limbs on R and muscle sense somewhat disturbed. R palpebral fissure larger than L; weakness in outward rotation R eye; both corneas less sensitive than normal; secondary optic atrophy more marked on R. X-ray: sella turcica much enlarged with thinning of walls and marked encroachment on sphenoid sinuses.	Operation refused.	Unknown.	Personality changes over a period of 5 years reported by family. Slight aphasia of predominantly receptive type. Some confusion, hesitancy and faulty articulation in speaking. Understanding of more complex material, spoken or printed, poor. Apathetic and sometimes uncooperative and suspicious. Aphasic symptoms aided in the diagnosis.	
16	51	L but trained to use R for writing and sewing.	Adenocarcinoma of L temporal lobe.	35 years. 3 months. 2 weeks. On admission.	Severe migrainous headaches. Severe occipital headache, mostly on L, with frontal headache and tinnitus. Difficulty in vision. Vomiting spells Distinctly ataxic gait with tendency to stagger to R and L. Slight weakness lower R face. Bilateral choked discs of about 2 D., more marked on L with enlarged blind spots. Audiogram: 30 per cent loss of hearing for speech in R ear and 32 per cent in L.	L temporo-parietal craniotomy, with removal of tumor lying in parietal region at a depth of about 5 cm	*Post-operatively.* Slight R hemiparesis and more severe aphasia, temporary improvement. Case of metastatic carcinoma but no evidence of primary lesion found. Death occurred about four months after operation.	For 3 mos. had noticed increasing difficulty in remembering names for persons and objects. Aphasia predominantly receptive but preoperative picture not clear. Some difficulty in naming, but otherwise very little change in speech. Most marked difficulties in reading and writing. The aphasic symptoms were of distinct value and indicated the side of the operation.	Receptive aphasia more severe. Speech well articulated, but limited and somewhat confused. Naming greatly disturbed. Some difficulty in understanding spoken language which was not present before operation.
III. EXPRESSIVE-RECEPTIVE GROUP									
1	32	L	Subcortical glioma of L temporal lobe.	2 years. On admission.	Momentary complete loss of vision. Occasional dull frontal headache. Reflexes hyperactive but not pathological. Marked bilateral choked discs: 7 D. on R and 8 on L. R homonymous quadrantanopsia. X-ray: atrophy of dorsum sellae and posterior clinoids.	Ventriculography followed by L temporo-occipital craniotomy revealing large yellow soft area believed to be inoperable glioma.	*Post-operatively.* R hemiparesis and severe aphasia, both of which persisted until his death 3½ years after operation	(For 2 years had noticed that reading slower and more difficult than before. Aphasia not definite.)	Severe aphasia affecting both expressive and receptive processes.
1	34	R	Spongioblastoma multiforme of the L frontal, temporal, and parietal lobes (necropsy).	1 month. On admission.	Speech difficulty, headache, nausea, vomiting, and difficulty in vision. Weakness lower R face and arm, with hyperactive biceps and triceps reflexes. Bilateral choking, more marked on L. Almost constant tasting and smacking movements of the lips and tongue. X-ray: slight calcification of pineal body.	*First:* exploratory craniotomy over L temporal area with evacuation of gliomatous cyst. *Second:* 1 month later: Evacuation of cyst with removal of portion of tumor	*Post-operatively:* Satisfactory progress for 2 weeks when hemiparesis and more severe aphasia developed *Post-operatively.* Condition unsatisfactory. Death occurred a week after operation.	(Speech difficulty of one month's duration. Mentally dulled on admission and disoriented for time and place. Aphasic symptoms were manifested first and aided in the diagnosis.) Increasing apathy and aphasia worse than immediately after the first operation.	Apathetic. Severe aphasia affecting both expressive and receptive processes. No speech response and no response to questions or directions.
IV. AMNESIC GROUP									
3	35	R	Astrocytoma of L frontal, temporal, and parietal lobes (necropsy)	11 years. 7 years. 2 years. 1 year. On admission. On readmission, 1 year, 2 months later.	Jacksonian convulsions of tongue and R side face and arm, and more rarely, whole R side. Numbness R arm. Difficulty in vision, particularly after a convulsion. Difficulty in speech, at first only after convulsion Some loss of power R limbs. Increasingly frequent convulsions. Headache, pain in R arm and aphasia. Weakness lower R face. R knee and Achilles reflexes exaggerated. Marked sensory disturbances whole R side. R upper limb ataxic and astereognosis in R hand. Pupils irregular and slightly sluggish to light, some nystagmus on extreme rotation. R homonymous lower quadrantanopsia. X-ray: marked calcification of vessels on L in motor parietal temporal area about the region of the optic thalamus. Weakness R face, arm, and leg with usual increase of reflexes and Babinski. Marked sensory disturbances on R.	L fronto-temporo-parietal craniotomy with partial removal of an infiltrating glioma which had invaded the pre- and post-central gyri and the parietal lobe and extended inwards and possibly implicated the thalamus.	*Post-operatively.* Complete R hemiparesis and more severe aphasia. Power on R gradually returned until he was in much the same condition neurologically as before operation. Sensory Jacksonian attacks lessened for a time but after about 2 months all symptoms became increasingly marked. Death occurred 11 months after operation	Marked difficulty in evoking words as names from time of first examination 1 yr. 2 mos. before operation. Central amnesic difficulty apparent in many language processes. Aphasic symptoms first present 4 yrs. after beginning of symptoms and in conjunction with other signs were of aid in the diagnosis.	More severe aphasia than before operation but still of amnesic type. Slight improvement during first two months, followed by marked deterioration. No further change during the last months of his life.
17	36	R	Spongioblastoma of L temporal lobe	2 months. 5 weeks. On admission.	Convulsion lasting 20 minutes with unconsciousness. No recurrence. Difficulty in vision. Difficulty in finding words. Headache, nausea, vomiting, dizziness, tinnitus L ear. Uncertain gait with tendency to fall to L. R homonymous hemianopsia. Bilateral choking of about 2½ D.	L fronto-temporal craniotomy with exposure of tumor lying in temporal lobe posterior to Rolandic fissure.	*Post-operatively.* R hemiparesis which improved slightly for a few months, and more severe aphasia. Death occurred 6 months after operation	Marked aphasia of amnesic type. Patient studied both before and after operation. Aphasic symptoms of distinct aid in establishing side of lesion	Aphasia more severe, with speech performances so limited that type was no longer clear. No improvement, and is reported not to have talked at all during last 2 months of life.
18	32	R	Gliomatous cyst of L temporo-parietal area, astrocytoma.	7 years. 4 years. 2 months. 1 month. On admission.	Generalized convulsion beginning in R hand and face with unconsciousness, following birth of first child. A second attack 3 weeks later. About the same time began to have chattering spells of jaw, trembling of R hand, and biting of tongue 6 other major seizures preceding and following birth of second child. Another major seizure. Diplopia. Increased intracranial pressure. Bilateral choking of about 3 D. on each side. Enlarged blind spots.	Exploratory operation over L temporo-parietal area which did not reveal a lesion. *Second.* 14 months later. Evacuation of large temporo-parietal gliomatous cyst with removal of part of tumor *Third.* 10 months after second: Evacuation of gliomatous cyst and large mass of tumor removed from L frontal area.	*Post-operatively:* Severe aphasia and several generalized convulsions. Chattering spells persisted, and a few major convulsions. 12 months after operation bumped her head on getting into a car and afterwards had several attacks of paralysis of R arm and leg with numbness and a senseless sort of speech. Examination revealed marked weakness R face, arm, and leg with increased reflexes and a Babinski, and paresthesias in upper and lower extremities. *Post-operatively.* Paresis and speech disturbances gradually improved, but chattering spells persisted and in about 6 months became more frequent. Cyst punctured several times during next two months with temporary improvement in speech and motor power. *Post-operatively.* Condition about the same. R hemiparesis, headaches, and aphasia. Cyst again tapped a year later without much change in condition. 3 months later reported progressively worse.	(No changes reported prior to admission or before first operation.) (Marked aphasia.) Severe aphasia.	(Severe "motor" aphasia which cleared up in about 3 months, but returned about 12 months after operation.) (Aphasia improved but in about 6 months patient complained of apathy and loss of memory.) Examinations made during admission when cyst was punctured revealed aphasia of amnesic type. Considerable emotionality. (Severe aphasia.)
42	13	R	Abscess of L central and parietal areas.	1 month. On admission.	First of attacks of severe headache, others, accompanied by vomiting and drowsiness followed. Sudden attack of Cheyne-Stokes respiration. Spinal fluid examinations showed increased cell count but no definite bacteriological findings. Dullness, apathy, and headache; stiff neck and positive Kernig's sign. Complete paralysis lower R face and arm, slight of leg, increased reflexes but no Babinski. Slight ptosis L lid; paralysis R sixth nerve, definite bilateral choking, more marked on R.	First operation one month after admission and a series of operations after this, showing large abscess in L central and parietal areas.	*Post-operatively.* Greater paresis on R and R homonymous hemianopsia. Aphasia developed 3 months after onset. Some improvement in motor power; R homonymous hemianopsia persisted, papilledema decreased, leaving secondary optic atrophy.	(Dulled, apathetic. Aphasia did not develop until 2 mos. after first operation.)	Examination 2 months after aphasia had developed showed severe amnesic aphasia.
47	11	R	Abscess of L temporal lobe.	Several years. 2 weeks. [illegible]	[illegible] running L ear [illegible] difficulty in speaking, photophobia, pain in eyes. [illegible] R face. Hyperactive reflexes on R with Babinski. [illegible] Concentrically [illegible] fields.	Two stage operation over L mastoid area, revealing a discharging sinus leading for 2 inches into the brain tissue: drainage.	*Post-operatively.* Condition improved very rapidly and patient was apparently entirely normal on discharge [illegible] weeks after operation	Aphasia of amnesic type in conjunction with other symptoms was of distinct help in localizing site of lesion.	Aphasia decreased after the first stage of the operation and cleared up very rapidly after final stage.

symptomatology of any aid, for while in Case No. 7 the symptoms were eleven years in duration, in cases No. 17 and No. 42 they were only a few months.

From the localization standpoint, in five cases of the total group of fifteen aphasia developed after operation; in two of these there were alterations of personality and other vague symptoms, but no definite aphasia was reported until after operation; in the remaining ten, aphasia was present before operation. Of these ten the aphasic symptoms were of help in conjunction with others in establishing the side of the lesion in cases Nos. 34, 59, 44, 58, 2, 8, and 7, and because of the paucity of the other symptoms they were of particular assistance in cases Nos. 60, 17, and 47.

2. PSYCHOLOGICAL CHARACTERISTICS

When the psychological characteristics of the tumor cases as a group are compared with those of the vascular or traumatic groups, certain differences become apparent. The tumor cases are on the whole slightly more variable, and with the exception of the amnesic patients they show a less clear-cut disorder. These two differences are sufficiently marked to warrant attention, but it must be noted that they are not characteristic of the individual tumor case as opposed to the individual vascular or traumatic case. There are wide differences within the tumor group as well as within the vascular or traumatic, so that some tumor cases, for example, are actually less variable or show less complicated disorders than individual vascular cases.

With regard first to the question of variability, it must be noted that all aphasic patients are likely to vary in their success with single test items. They name an object correctly one day, for instance, and fail to name it the next. But a better criterion of variability than this response to single items is the average performance on a number of items. Judged on the basis of average performance, vascular and most traumatic cases may improve steadily or regress, but they do not show appreciable daily fluctuations. Tumor cases are more likely to show such fluctuations, although even here the difference between the performances on one day and on the next is not great. Large fluctuations, however, do appear in a few tumor cases and may be related directly to the acute lesion and the rapid changes in pathology.

In some cases, generally either shortly pre- or post-operative, the condition is so acute that the patients cannot be examined in any systematic way and so individually are of little value in a study like this. In fact, no such patients were included in this group unless more satisfactory examinations could be made when the general condition was better. In the acute stages responses are not only difficult to elicit but extremely irregular. The irregularity, however, is certainly not characteristic of the language responses alone, but of all reactions. It is the result of the disturbed condition of the whole organism, and specifically of the rapid pressure and edema changes in the brain. Considered from the practical rather than the research point of view, it must be noted that test results may be valuable even in this condition, but only for their positive findings. In other words, the results are important in so far as they show what the patient can do, but the negative results do not establish limits of ability and are significant only as gross indices of the relative difficulty in different kinds of performance.

The second group of cases which may show a large amount of variability in performance is also characterized by great changes in the pathology. These patients may be regular and consistent in their performances on any one day, but they may have changed considerably by the next day if there has been an increase or decrease in pressure. An excellent example is No. 18 whose performances varied according to the condition of the fronto-temporo-parietal cyst and improved after it had been tapped.

The differentiation between the tumor and the vascular or traumatic cases on the basis of the clear-cut or complicated disorder really affects only a part of the tumor group. It has already been noted that the amnesic disorder, which appeared among these patients only in tumor cases, is relatively clear-cut and that the changes depend almost entirely on difficulty in evoking words as names. With regard to the expressive-receptive patients where the disorder is by definition one which affects all language processes, there is of course no question of a clear-cut disorder. The matter affects only the expressive and receptive patients, then, and of these it may be said that while the distinction between predominantly expressive and predominantly receptive can be made for the tumor cases, it is less satisfactory than for the vascular or traumatic cases. The tumor patients of the predominantly expressive type are likely to show changes more characteristic of the predominantly receptive disorder, and vice versa. For instance, the expressive patients in addition to their typical errors in articulation and word-formation, are likely to have difficulty in evoking words and to produce verbal and grammatical confusions. Interestingly enough, all the patients chosen to illustrate the expressive or receptive disorders in Chapters VIII through XI were vascular or traumatic in origin. The failure to choose tumor cases was unintentional, and in part fortuitous; since few tumor cases could be examined for long periods, their records are less complete and decisive. In part, however, it resulted from the fact that few of the expressive or receptive tumor cases were so clear-cut as those from other types of pathology.

3. SUMMARY

In ten of the fifteen tumor or abscess cases aphasic symptoms were present before operation, and in two others there were alterations in personality with other vague symptoms which on closer analysis might have been shown to be aphasic, while in the remaining three the speech disturbances developed after operation. In practically all cases the aphasic symptoms were of help in localization, and in three because of their early appearance and the paucity of other symptomatology, the speech disturbances were of distinct value, but only in determining the side of the brain in which the lesion was located. By no means was there any evidence of a stricter localization.

The tumor cases as a group differed from the vascular in two characteristics: they were more variable and with the exception of the amnesic patients they showed less clear-cut disorders. The greater variability is undoubtedly to be related to the acute lesions and the rapid changes in pathology. The fact that the expressive and receptive disorders were more complicated in the tumor than in the vascular cases, and consequently that the tumor case was more difficult to classify as either predominantly expressive or predominantly receptive, must depend on the larger area affected in the tumor cases, but without a complete destruction, i.e., with certain intact axis cylinders still remaining.

XIII

THE CONTROL GROUP OF PATIENTS WITH RIGHT-SIDED LESIONS AND NO APHASIA

1. The nature of the group
2. Test levels in relation to the normal
3. Correlational findings
4. Analyses of errors, difficulty value of test items, speed in work, and memory span
5. Summary

I. THE NATURE OF THE GROUP

IN the total group of 98 cases with unilateral cerebral lesion, there were 25 with demonstrated lesions in the right hemisphere or neurological signs of such lesions. Of these 3 showed aphasia—one right handed, one left handed, and one apparently ambidextrous. The remaining 22 were all right handed and none showed aphasia. Among the 25 cases, therefore, the right-handed patient with aphasia and neurological signs of lesion in the right hemisphere is the only definite exception to the rule that aphasia comes with injury of the dominant hemisphere as indicated by handedness.[1] The matter of cerebral dominance will be discussed in relation to the whole group in Chapter XVIII. The problem of the present chapter is the study of mental functioning in cases where there is a unilateral cerebral lesion but no aphasia or history of speech difficulty. For this purpose the right-handed patients with signs of lesion in the left hemisphere but no aphasia might also have been used if it had been possible to prove beyond a doubt that they had had no speech difficulty at the time of the attack. Since there was no positive proof, however, these cases were not included, and the study was based on the 22 right-handed patients with demonstrated lesions or neurological signs of lesions in the right hemisphere and no aphasia or history of it.

---

[1] Handedness is often difficult to determine, for there are no decisive tests and the judgment must be based on a number of criteria such as the hand used in writing, eating, throwing a ball, holding scissors, pushing the thread through a needle, dealing cards, or reaching for a knob or handle, and on the position of the two hands in bimanual activities like holding a baseball bat, golf club, shovel, rake, or broom. Even for normal persons a satisfactory judgment is difficult. Sometimes the right hand is used for certain unimanual activities and the left for others, and sometimes the right is preferred for unimanual but the position of a typically left-handed person is taken for bimanual. With these patients where there was almost always some loss of motor function or disturbance in sensibility, the various activities often could not even be tried out, and the decision had to be based largely on the patient's report or his family's report. Furthermore, a knowledge of the handedness alone is not sufficient; it is important to find out as much as possible about "sidedness" and consequently to determine which is the preferred foot and which the preferred eye. Pathological conditions naturally interfered with the determinations here as well. So far as possible, eyedness was tested by Miles' A.B.C. Vision Test which gives an index of the eye used in sighting (see Appendix II).

The data on the composition of this group have been presented in Table III and discussed in Chapter V.[2] The median age, 48 years, is slightly higher than that of the aphasic group and eleven years higher than that of the normals. The group is lower than either the aphasic or the normal in both educational and occupational status. It contains a smaller proportion of women than do either the aphasic or the normal groups, and a larger proportion of colored.

A further characteristic of the group has already been mentioned in the description in Chapter V. It differs from the normal in containing a number of chronic cases. In nine of the twenty-two the disorder was of more than two years' standing, and it is probable that the lower social classes are more heavily weighted among these chronic nervous cases than among the surgical or even the orthopedic cases selected as controls.

It might be supposed that some of these chronic cases, because of their long hospitalization, would have lost interest in such work as that presented by the tests. If so, their willingness to try any diversion compensated for lack of true interest. In general all the cerebral lesion cases cooperated well. The only exceptions to this rule were two: a tumor case examined shortly before operation and too ill to be able to make a steady effort or cooperate well, and one of the left hemiplegics who worked well until he was tested on a reaction-time apparatus and then became suspicious and unwilling to go on with the examination.

2. TEST LEVELS IN RELATION TO THE NORMAL

A comparison of the 22 cases of right-sided lesions without aphasia with the total group of normals showed the cerebral cases lower in every performance

---

[2] The group contains 19 cases of vascular lesions and 3 of tumors. For a fine analysis of the mental changes the vascular and tumor groups should be separated, but for the relatively gross analysis at this stage of the work the two have been treated together so as to increase the size of the group.

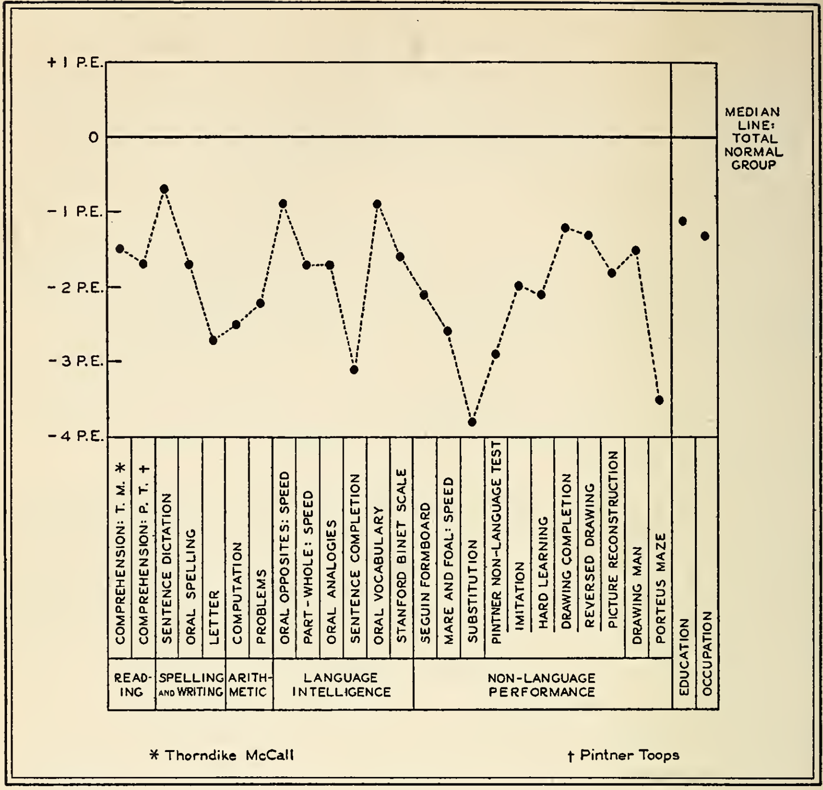


Figure 15. Relation of the median performance level of the group of 22 cases of right-sided cerebral lesion without aphasia to that of the total normal group

tested. The extent of their inferiority in the most important tests is represented graphically in Figure 15, shown above, where their scores are expressed in terms of the variability of the normal group. Levels for occupation and education are given as well as for test scores. The solid horizontal line represents the normal median level, the dotted line the level for the cerebral lesion cases. It will be evident that they most nearly approach the normal in writing sentences to dictation, in their speed in giving responses on the Opposites Test, and in defining words presented orally. In general they are closer to the normal on tests of reading, writing, and language intelligence than on tests of arithmetic and non-language performances.

The inferiority of the cerebral lesion cases in comparison with the normal

	MALE		FEMALE	
AGES	*White*	*Colored*	*White*	*Colored*
58–59	o x	x x	o o o x	
56–57	o o x			
54–55	x	o	o x x	
52–53		o	x	
50–51		x		
48–49		o o o		
46–47		o		
44–45		o x x		
42–43		o		
40–41		x		
38–39				x
36–37				
34–35	x	o x		
32–33	o o	o		
30–31	x			
28–29	o x	x		
26–27				
24–25		x		
22–23				o
20–21		x		
18–19				
16–17				
14–15	x			
12–13	o			

o = cases of right-sided lesion without aphasia
x = matched normal cases

Figure 16. Age, sex, and race distributions for 22 cases of right-sided lesion without aphasia and for the matched normal group

undoubtedly depends in part on the fact that the former are as a group older. In analyzing the relation between age and test performance for the normal cases, it was found that the older subjects were like the younger on tests of reading comprehension, writing to dictation, and vocabulary but fell below the younger on many of the non-language tests. The greater age of the cerebral lesion cases would not help to explain their inferiority in arithmetic, however, for there was little difference between the older and the younger normal subjects in this field. Another point to be considered is that some of the inferiority of the cerebral lesion group may result from the fact that it contains a larger proportion of colored than the normal group does. Comparison of the findings for colored and white in the normal group showed that the colored were superior only on the Porteus Maze Test; they were inferior in all other performances tested and significantly inferior on the Morrison McCall Spelling Test, the letters, the Stanford Binet Vocabulary, the Pintner Non-Language Scale, and two of its sub-tests, the Drawing Completion and the Reversed Drawing. It must be noted, however, that the larger proportion of colored would not explain all the differences between the cerebral lesion group and the normal. The colored normals are somewhat superior to the whites on the Porteus Maze Test, yet the cases of right-sided lesions are significantly below the normal. The opposite situation occurs on the Binet Vocabulary Test where the colored normals are significantly below the white, but the group of cerebral lesions with its larger proportion of colored approaches the normal fairly closely.

To eliminate as many as possible of the uncertainties arising from inequalities in the composition of the two groups, a special group of normals was selected identical to the group of cases with right-sided lesions in race and sex distribution and similar in age. Figure 16, page 325, shows that the matched group thus obtained was fairly satisfactory for comparative purposes, although the ages could not be raised quite to those of the group of cerebral cases. The median ages for the two groups are as follows:

Matched normals		*Cases of right-sided lesions*	
Total group	45 yrs.	Total group	48 yrs.
Males	41 yrs.	Males	46 yrs.
Females	55 yrs.	Females	58 yrs.
White	53 yrs.	White	56 yrs.
Colored	41 yrs.	Colored	47 yrs.

It was possible to make the matched group represent almost the same hospital distribution as that of the group of cerebral lesions.

	Matched normals	*Right-sided lesions*
Philadelphia General Hospital	13	14
Graduate Hospital	5	5
Orthopedic Hospital	4	4
Temple University Hospital	0	1

Nevertheless the educational and occupational status for the group of normals thus matched for age, sex, and race was superior to that for the cases of cerebral lesion, although not significantly so. The difference is probably the result of the condition already discussed, namely, the larger representation of the lower social classes among the chronic hemiplegics in the hospital wards than among the surgical and orthopedic cases.[3]

In order to make an altogether satisfactory study of the characteristics of mental functioning in cases of unilateral cerebral lesion without aphasia or even an absolute determination of those performances in which such patients differ most from the normal, it would be necessary to enlarge the cerebral lesion group until it finally contained a good number of the middle occupational and social classes. It goes without saying that all the factors operating in the selection of the cerebral lesion group cannot be controlled by the use of a matched normal group as a basis for comparison. Furthermore, the small size of the matched normal group introduces uncertainties on its own part. But in view of the fact that uncomplicated cases of unilateral cerebral lesion without aphasia, such as these were, accumulate rather slowly, the major part of the data will be presented to show the general tendencies.[4]

In comparison with the matched group as with the total normal group, the cases of right-sided lesion are inferior in all performances tested. In every instance except one, the level on the Pintner Toops Directions Test, the extent of their inferiority is less than in comparison with the total normal group. In Figure 17 (page 328), the solid horizontal line represents the median level for the matched group of normals and the dotted line below, the scores for the group of cerebral lesion cases expressed in terms of the variability of the matched normals. The two dots on the right-hand side of

---

[3] A correlation of the scores on the Stanford Binet Scale and the duration of the disorders in these cases of right-sided lesions gives: $r = -.24 \pm .16$. Age, however, is undoubtedly an important factor which would have to be ruled out before the part of the duration of the disorder could be determined.

[4] There are no reports of mental functioning in unilateral cerebral lesion cases without aphasia with which these data can be compared. The only studies up to the present are of mental changes in tumor cases or of work capacity, immediate memory, or other isolated performances in brain injury cases. In his recent book Kleist tabulated the results of about a hundred mental tests of brain injury cases, most of them without aphasia (*op. cit.*, 549). He was interested in determining the relative effect of frontal, central, and occipital lesions; and to provide for a qualitative analysis of the differences he grouped his tests, which were apparently of the Binet Scale, under the headings of judgment, memory, reproduction, knowledge, and attention. The tests are not satisfactory for a fine analysis, but it is interesting to note that Kleist believes that the greatest change in intelligence as indicated by these tests comes with injury in the speech region and the next greatest with occipital injuries. He also found a more marked change with injuries of the left than of the right hemisphere but did not go into the question of handedness.

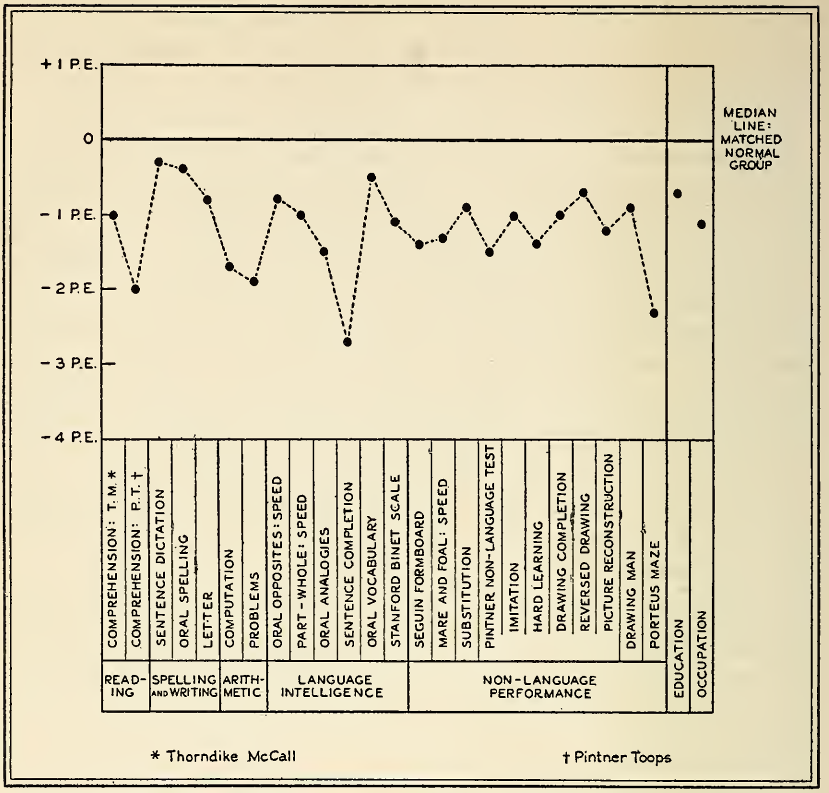


Figure 17. Relation of the median performance level of the group of 22 cases of right-sided cerebral lesion without aphasia to that of the matched normal group

the graph mark the positions of the cerebral lesion cases in relation to the matched normals in education and occupation. It will be evident that many of the test levels correspond roughly to the educational and occupational levels. Consequently, much of the inferiority which the cerebral lesion group shows is probably to be attributed not to their pathological condition but to the fact that they are a lower sample of the population in these respects. A comparison of this graph and that in Figure 15 bears out this statement, for it shows that when the cerebral lesion group is compared to normals matched as nearly as possible for age, sex, and race, the curve representing the performance levels is smoother (AD .46 as against .65).

In other words the pathological cases occupy a more regular position below the matched normal than below the total normal group, and this is the condition which would be expected if they were like normals of the same age, sex, and race distribution but lower grade.

The fact that the cerebral lesion cases represent a below-average sample of the population does not account completely, however, for the test findings. Even in comparison with the matched normals their performance levels are irregular. They approach the normal most closely, and surpass the levels which might be expected of individuals of their educational and occupational status, on at least three tests: the sentence dictation, the oral spelling, and the oral vocabulary. It is noteworthy that these are language tests involving the reproduction of acquired knowledge in situations not unfamiliar to everyday experience. They fall furthest below the normal on the Sentence Completion Test, which involves constructive synthetic mental activity in a situation which is not difficult for them to grasp, but still a less natural situation.

It is possible that some of the poor performances on non-language tests might also be explained by an abnormal difficulty in adjusting to a strange test situation. A difficulty in adjustment, however, would hardly account for marked inferiority which the cerebral lesion group showed on arithmetic computation and arithmetic reasoning tests, and the performances on both tests were poorer than the relatively low educational levels would explain. In short, the cases of right-sided cerebral lesion without aphasia seem to be most like the normal on a few of the language tests, and less like the normal on non-language and arithmetic tests. This situation is of great interest in view of that found in cases of unilateral cerebral lesions with aphasia, where the greatest differences from the normal appear in language performances and the patient usually approaches the normal much more closely in non-language work and in arithmetic. The group presented here is obviously inferior to the normal and is not a satisfactory basis for the determination of the extent of the change dependent upon the pathological condition, but it is sufficient evidence that the cases of right-sided lesion without aphasia do not simply manifest a slighter degree of the aphasic condition.[5]

---

[5] It would be interesting to find the correlation between the extent of the lesion and various indices of intelligence in cerebral cases such as these, but difficulty in estimating the extent of the lesions made such determinations impossible.

When the facts are approached in another way, by statistical determinations of the significance of the differences between the normal and pathological groups in median scores on each test, it seems even more clear that the cases of right-sided lesion are qualitatively unlike low-grade normals and that the changes they show are almost the reverse of the aphasic changes. For the battery of tests discussed here there is a significant difference between median scores for the total normal group and for the cerebral lesion group in ten instances, and for the matched normal and the cerebral lesion group in only one, the Porteus Maze Test[6] (Table XV). Expressed

TABLE XV

SIGNIFICANCE OF THE DIFFERENCES BETWEEN MEDIAN SCORES FOR THE GROUP OF CASES OF RIGHT-SIDED LESIONS

	IN RELATION TO THE TOTAL NORMAL GROUP		IN RELATION TO THE MATCHED NORMAL GROUP	
	$\frac{D}{PE_D}$	*Chances in 100 that the true difference is greater than 0*	$\frac{D}{PE_D}$	*Chances in 100 that the true difference is greater than 0*
Pintner Toops Directions .	4.95	100	3.64	99
Arithmetic				
Computations . . .	5.31	100	3.72	99
Problems	4.24	100	3.57	99
Pintner Non-Language Test	6.35	100	3.89	99
Imitation	5.18	100	2.43	95
Hard Learning . . .	5.27	100	3.01	98
Reversed Drawing . .	5.19	100	1.75	88
Picture Reconstruction .	9.13	100	3.75	99
Goodenough Drawing Test	6.65	100	2.47	95
Porteus Maze Test . . .	5.67	100	4.65	100
Occupational rating . .	4.00	100	2.00	91

---

[6] There are other instances of significant differences outside of the battery discussed here. The $\frac{D}{PE_D}$ of the Easy Learning Test of the Pintner Non-Language Scale was also significant for the cerebral lesion group and the total normal group, but this test was so easy for the normal subjects that the distribution was poor, and the results were therefore discarded.

When the cases of right-sided lesion were compared to the total normal group there were significant differences on two of the separate tests of the Stanford Binet Scale: the Sentence in other terms, it may be said that, if the normals were a random selection of normal adults and the cases of right-sided lesion a random selection of adults with such lesions, the normals would always give median scores superior to the cerebral lesion cases, and further that similarly matched normals would always surpass the pathological cases in median score on the Porteus Maze Test.[7] It is again apparent that these cases with demon-

Construction at Year IX and the Designs at Year X. There were large but not significant differences on the following tests: Dissected Sentences, Reversed Digits, Enclosed Boxes, Ball and Field, and Arithmetic Problems.

The cases of *left*-sided lesion with no aphasia, at least at the time of the examination, have not been reported because of the small size of the present group. It is worth noting, however, that the largest differences between these cases and the normal appear in quite another list of tests: the Absurdities, the Vocabulary at Year X, the Comprehension Questions at Year X, and the Reading and Report. These tests differ in nature from those where the cases of *right*-sided lesion are most unlike the normal. They are predominantly linguistic; of the Absurdities and the Comprehension Questions it might be said that they require insight into practical situations but still demand some degree of language facility. The tests on which the cases of right-sided lesion differ most from the normal, on the contrary, probably involve spatial and numerical rather than verbal abilities.

There is a large difference between the cases of right-sided lesion and the normal on still another test, the Feature Profile Puzzle of the Pintner Paterson Performance Scale, but the extent of this difference could not be calculated, for while the median normal time for completing the puzzle was 102 seconds, fewer than half of the cerebral lesion cases finished within the time limit of 300 seconds.

[7] In view of the fact that the groups were so small, it seemed wise to determine the significance of the difference between means on some of the more important tests by Fisher's formula, as given in *Statistical Methods for Research Workers* (3d ed.; Edinburgh: Oliver and Boyd, 1930), 107 ff.

When the cerebral lesion cases were compared with the matched normals, neither the difference between the means for occupation in terms of points on the Barr Scale nor that between the means for education in terms of number of years' schooling is significant; the respective P's are .2 and .7. There are significant differences, however, between mean scores for some of the tests. Calculations were made for the Sentence Completion, where the cerebral lesion cases seemed to fall very low on the normal distribution, and for all the tests noted in Table XV except the sub-tests of the Pintner Non-Language Scale, in other words, for all the main tests showing significant differences between the medians for the cerebral lesion and total normal group. The P's for these tests are as follows:

Sentence Completion	.05
Pintner Toops Directions	.01
Arithmetic Computations	.02
Arithmetic Problems	.02
Pintner Non-Language	.01
Goodenough Drawing	.01
Porteus Maze	.01

Fisher would consider the differences for all these tests, being under .05, as significant, and those for the last six tests, which are under .02, would be generally recognized as significant.

In short, this finer statistical treatment supports the findings already indicated, to the effect that while the cerebral lesion cases are inferior to the matched normals in occupational and educational level, they are not significantly inferior in these respects; they are significantly inferior, however, on the arithmetic and on most of the non-language tests.

strated lesions or neurological signs of lesions in the right hemisphere differ most markedly from the normal, first, in arithmetic tests and, second, in non-language tests which vary in nature but all apparently involve the appreciation and manipulation of forms and spatial relationships.[8]

3. CORRELATIONAL FINDINGS

The cases of right-sided cerebral lesion form too small and too heterogeneous a group at present for the correlational findings to be of much significance. A number of correlations were made, however, the more important of which are the following:[9]

Stanford Dictation—Oral Spelling	+.91 ± .04
Arithmetic Computation—Arithmetic Problems	+.82 ± .06
Arithmetic Computation—Stanford Binet Scale	+.87 ± .05
Arithmetic Computation—Pintner Non-Language	+.68 ± .12
Arithmetic Computation—Imitation	+.60 ± .14
Arithmetic Computation—Hard Learning	+.76 ± .09
Arithmetic Computation—Drawing Completion	+.61 ± .13
Arithmetic Computation—Reversed Drawing	+.59 ± .14
Arithmetic Computation—Picture Reconstruction	+.64 ± .13
Arithmetic Problems—Stanford Binet Scale	+.81 ± .07
Oral Opposites, Speed—Binet Vocabulary	+.58 ± .11
Oral Opposites, Speed—Stanford Binet Scale	+.73 ± .08
Sentence Completion—Stanford Binet Scale	+.75 ± .09
Sentence Completion—Pintner Non-Language	+.76 ± .09
Stanford Binet Scale—Pintner Non-Language	+.78 ± .07
Stanford Binet Scale—Imitation	+.62 ± .12
Stanford Binet Scale—Hard Learning	+.74 ± .09
Stanford Binet Scale—Drawing Completion	+.59 ± .12
Stanford Binet Scale—Reversed Drawing	+.71 ± .09
Stanford Binet Scale—Picture Reconstruction	+.59 ± .12
Stanford Binet Scale—Drawing of a Man	+.42 ± .15
Stanford Binet Scale—Porteus Maze	+.66 ± .11
Formboard, Seguin—Hard Learning	+.95 ± .02
Formboard, Mare and Foal Speed—Drawing Completion	+.93 ± .03
Pintner Non-Language—Drawing of a Man	+.32 ± .18

---

[8] Among the tests showing significant differences between the cerebral lesion group and the total normal group, as reported in Table XV, there is only one of those classed with the language tests, namely the Pintner Toops Directions Test. This test requires the understanding of reading and in so far it is a language test, but in the carrying out of the directions non-verbal factors are probably of great importance.

[9] In view of the small size of the group, these correlations were determined by the method of Rank-Differences, and then transmuted into Product Moment *r*'s.

Pintner Non-Language—Porteus Maze	+.88 ± .05
Correlations of Sub-Tests of the Pintner Non-Language Scale	
Imitation—Hard Learning	+.79 ± .07
Imitation—Drawing Completion	+.83 ± .06
Imitation—Reversed Drawing	+.65 ± .11
Imitation—Picture Reconstruction	+.96 ± .01
Hard Learning—Drawing Completion	+.84 ± .05
Hard Learning—Reversed Drawing	+.78 ± .07
Hard Learning—Picture Reconstruction	+.59 ± .12
Drawing Completion—Reversed Drawing	+.59 ± .12
Drawing Completion—Picture Reconstruction	+.57 ± .12
Reversed Drawing—Picture Reconstruction	+.33 ± .16
Age—Stanford Dictation	+.17 ± .19
Age—Arithmetic Computation	−.23 ± .19
Age—Binet Vocabulary	+.57 ± .12
Age—Stanford Binet Scale	+.05 ± .16
Age—Pintner Non-Language	−.13 ± .19
Age—Barr Occupational Rating	+.12 ± .15
Barr Occupational Rating—Stanford Binet Scale	+.69 ± .08
Barr Occupational Rating—Pintner Non-Language	+.61 ± .12

4. ANALYSES OF ERRORS, DIFFICULTY VALUE OF TEST ITEMS, SPEED IN WORK, AND MEMORY SPAN

A qualitative study of the differences between the cerebral lesion cases and the normal in specific performances was approached through analyses of errors and of the difficulty value of items within the test, comparisons of levels in speed and in quality of performance or amount accomplished, studies of work curves for the normal and pathological groups, and data on memory span.

Analyses of Errors. An analysis of errors in oral reading (Gray Oral Reading Tests) showed approximately the same percentages of mispronunciations and omissions among the cerebral lesion cases as among all the normals, but a slightly lower percentage of insertions among the former and a slightly higher percentage of repetitions. The differences were not at all striking and probably result from the fact that the cerebral cases were on a lower level in reading. Their speed was far below the normal and it is possible that insertions are more characteristic of rapid reading and repetitions of slow reading.

Spelling errors in writing to dictation were divided into letter, syllable, and word omissions, substitutions, additions, repetitions, and reversals and miscellaneous errors. The percentages of errors in each class differed only slightly for the cerebral lesion and the normal groups, showing that there was no greater tendency to any one type of error in the pathological than in the normal group.

As the errors were divided into classes a further differentiation was made, namely, between those which were justifiable phonetically and those which were not. On this count the cerebral lesion cases differed somewhat from the normal, for only about 7 per cent of their errors were phonetically justifiable as against the normal 12 per cent.

Difficulty Value of Test Items. Correlations of items of various tests ranked in order of their difficulty for the cerebral lesion and the total normal groups were high, indicating that there was little difference between the two groups in the relative difficulty of different items. This is of course not to say that the cerebral lesion cases had no more difficulty than the normals on the test in question, but that they usually had no more difficulty than the normals with one item of the test in relation to another. The following are Rank Difference correlations transmuted into *r*'s:

Morrison McCall Spelling	+.91 ± .02
Gates Oral Spelling	+.97 ± .07
Oral Opposites	+.77 ± .07
Oral Analogies	+.82 ± .03
Stanford Binet Scale	+.96 ± .01

Speed in Work. For the most part the tests used gave indices of the level of difficulty the patient could reach or the quality of his work rather than of speed. Some tests, however, were scored both in terms of amount accomplished, or quality, and in terms of rate of work. When the two sets of scores for the unilateral cerebral lesion group are compared with those of the matched normals, it is apparent that the pathological cases show no general tendency to fall further below in the one than in the other. The comparison can be made for the following tests:[10]

P.E. DEVIATIONS FROM MEDIANS FOR MATCHED NORMALS

	Time Scores	*Quality Scores*
Oral Opposites	—0.8	—0.8
Mare and Foal	—1.3	—2.0
Two-Figure Board	—3.9	—2.4
Casuist Board	—1.5	—1.1
Healy A Puzzle	—1.9	—0.9

The first is one of the few language tests which admit of separate time and quality scores. In most, the patient was allowed to continue at his own pace until he had finished as much as he could do, for the primary interest was not in his rate of work. Usually, however, he completed all the work he could do in the average time required by the normal, for he was not only slower than the normal but also unable to attempt the more difficult parts of the test. On this one language test the cerebral cases are equally poor in comparison with the matched normals in speed and in quality scores, but on three of the four "performance" tests they are further below in rate than in quality of work.

---

[10] Of these scores only the time scores for the Oral Opposites and the Mare and Foal Tests have been discussed before because these gave the most satisfactory distributions for the total normal group. For the matched normal group, however, both time and amount or quality scores on these five tests gave distributions which were sufficiently good to be used as a basis for estimating the inferiority of the cerebral lesion group in terms of PE deviation from the medians for the matched normals.

The differences are not great, but they suggest that the cerebral lesion cases are abnormally slow in carrying through complicated performances which demand considerable manual dexterity. A survey of the other tests of the battery where success depends largely on speed does not give further evidence of such a condition, however; the cerebral cases fall no further below the matched normals on the Seguin Formboard, the Digit-Symbol Substitution, and the Hard Learning Tests than on other non-language tests, where speed is not a factor.

A number of studies have been made of work curves for patients with cerebral lesions, in an effort to determine the amounts of physical work of various kinds which could be accomplished in successive time units for a certain interval. No specific studies of physical or mental work capacity were attempted here but two work curves were obtained as by-products of the tests in copying and the Digit-Symbol Substitution.[11] Two sets of curves were obtained for speed in copying for each patient. The first were based on number of words copied per minute. These were extremely irregular in form, both because of variations in amount copied per minute and of variations from four to eighteen minutes in the total time required to copy the 95 words. A second set of curves was therefore drawn on the basis of the percentage of the total amount of work done in each quarter of the total time expended by each patient. Again the individual variations in the forms of the curves were great, and there were no types apparent. Some cases showed initial drops followed by a rise in the third or fourth quarter, and others, the majority, showed an initial rise. No typical differences from the normal could be determined by inspection of the individual curves. When, however, a composite curve was drawn for those cerebral cases who were able to finish or almost finish copying the given section, it was like the normal curve in showing an improvement in the second quarter and a slowing down in the third, but the normal showed another rise in the fourth quarter while the cerebral lesion showed a further slowing down. The percentages of the total amount of work done in each quarter of the total time expended by each patient were as follows:

	First quarter	*Second*	*Third*	*Fourth*
Normals (N = 32)	23.5	27.1	24.2	25.2
Cerebral lesion cases (N = 6)	24.2	28.1	24.1	23.6

---

[11] The complete Woodworth Wells Substitution Test was used instead of the half usually given in the Pintner Paterson Performance Scale, so that the course of the performance with practice could be determined. For purposes of scoring, however, the first half was used as in the Pintner Paterson Scale.

The work on the Digit-Symbol Substitution Test was scored in terms of the percentage of the total time required for each successive two lines, and the curve thus obtained must therefore be considered as the reverse of a curve like that for the copying where records were made of the percentage of work done in a certain percentage of the time. The two curves revealed similar conditions: initial improvement for both groups, followed by a decline and further improvement for the normals and a decline with no improvement within the limits of the test for the cerebral cases:

	Percentage of total time for				
	first 2 lines	*second 2 lines*	*third 2 lines*	*fourth 2 lines*	*fifth 2 lines*
Normals (N = 41)	23.20	21.25	18.96	19.51	17.08
Cerebral lesion cases (N = 6)	20.17	20.25	19.78	18.66	21.13

Memory Span. It has sometimes been said that patients with brain lesions were likely to have a short immediate memory span, but these cases of right-sided lesions came very close to the normal in repeating series of digits, letters, disconnected words, and nonsense syllables after oral presentation, and in repeating series of digits and letters after visual presentation. Within the limits of the tests given, it seemed that they came closer to the normal in such reproductive tests than in most of the other performances studied.

5. SUMMARY

In view of the fact that the twenty-two cases of right-sided cerebral lesions without aphasia were as a group older than the normal and higher in the proportion of colored patients, a special group of normals was selected for comparative purposes. This matched group was identical to the cerebral lesion group in race and sex distributions and as nearly similar as possible in age. It was below the medians of the total normal group in occupational and educational status, but still slightly superior to the medians of the cerebral lesion group.

When compared to the matched group of normals the cerebral lesion cases were inferior in all performances tested, but significantly inferior in only one, that on the Porteus Maze Test. While individual variations were large, there was a tendency in the group as a whole for the cases with right-sided lesions to approach the normal more closely in many of the language tests than in arithmetic or most of the non-language tests. This condition could not be explained solely as the result of the more natural situation presented by the language tests in question. The problem merits further study, for these cases were not a good sample from the point of view of educational and occupational status. Nevertheless it seems clear that the cases of right-sided lesion without aphasia do not manifest a change similar to the aphasic. Instead of differing from the normal most clearly in language performances as the aphasic patients do, they show greater differences in arithmetic and non-language work. They seem to be not only inferior to the normal group, to an extent which is impossible to predict accurately from the present sample, but qualitatively different.

Correlational findings are presented in Section 3, but are probably of comparatively little significance because of the small size and the heterogeneity of the group.

Analyses of errors show very slight differences between the cerebral lesion cases and the normal; probably the only noteworthy finding is that the former tend to make grosser errors than the average normal person and that the percentage of their errors which is phonetically justifiable is lower than the normal.

Differences between the cerebral lesion patients and the normal with regard to the relative difficulty they encounter on different items in tests such as word dictations or oral analogies are small. There is no conclusive evidence that the cases of right-sided lesions are further below normal in the speed than in the quality of their work, or vice versa. Data on immediate memory span show that the cerebral lesion case is, if anything, less inferior to the normal here than in many other performances.

XIV

APRAXIA AND AGNOSIA

1. The case material
2. A case showing aphasia, apraxia, and agnosia: A.G.
3. Discussion of the concepts of apraxia and agnosia
4. Summary

I. THE CASE MATERIAL

OF the 218 cases of cerebral lesion investigated during the course of the research, 80 were interviewed and observed for a sufficient time to demonstrate that they had no disturbances of interest for aphasia, apraxia, or agnosia or that they were unsuitable for study because of some such complicating factor as unfamiliarity with English. The remaining 138 were all given thorough examinations, as were the 85 normal control cases and the 11 neurological cases which do not fall in the cerebral lesion group. These examinations included the specific tests for apraxia or agnosia whenever the need for such tests was indicated by the patient's behavior. These tests were not used in the majority of cases because it seemed obvious that apraxia and agnosia could safely be excluded if everyday behavior was normal and no signs of these defects appeared during the prolonged observation necessary in giving both the language and the non-language tests of the battery.

In spite of the fact that the group of cerebral lesion cases was large and carefully studied, few were of direct value for the study of apraxia. Only five showed motor or perceptual disturbances of such a character or such a degree in relation to other pathological changes that they could be defined as apraxic or agnosic. It is to be noted immediately, however, that the terms apraxia and agnosia are used in a limited sense which seems justified from the results of this research as a whole. In no case would either disorder be diagnosed simply on the basis of difficulty in the complex motor and perceptual performances sampled by the non-language tests of the battery, for such difficulties are shown, as discussed in Section 3, by both normal and pathological cases which no one would venture to call apraxic or agnosic. Furthermore, apraxia and agnosia, as here understood, do not include three other types of difficulties: the simpler speech defects; the inability to take given lip, teeth, and tongue positions when the production of speech sounds was not in question; and the faulty recognition of objects by touch which appears as astereognosis. The question of considering the difficulties in articulation or letter-formation as apraxic and in recognizing speech sounds or letter symbols as agnosic has already been discussed.[1] In this research these difficulties have been grouped with the more complex language disturbances which always accompany them rather than with the defects in movement and perception of an apraxic or agnosic nature. Some of the aphasic patients, not only those who failed to produce given sounds at command or repeat them but those who could produce the sounds well, nevertheless had difficulty taking given lip, teeth, and tongue positions at command or by imitation when the production of speech sounds was not required. Such difficulties could justifiably be called apraxic but they are not good criteria for differentiating between the normal and the abnormal, for many normal persons experience similar difficulties. In other words, they are not signs of a facial apraxia, but of failure to perform in part what has become normally a highly automatic performance.

A third form of disturbance shown by some of the aphasic patients, astereognosis, is sometimes classified with the agnosias, but was not so classified here. This disturbance could be demonstrated in 5 of the 60 aphasic patients and may have existed in a few other cases where severe aphasia made the study unsatisfactory. It was always accompanied by other disturbances of sensibility and seemed to be related to these rather than to the agnosias. In any case the material was not sufficient for definite conclusions to be drawn.

The record of one of the five true cases of apraxia and agnosia is presented in detail in Section 2 to show the methods of study which were used and the complexity of the disturbances demonstrated by them. The principal facts about the other four are briefly summarized in the following paragraphs:

A.A., female, Negro, 54; housework; education unknown; apparently right handed. Attack of unconsciousness, followed by weakness of right side three years before examination at the Philadelphia General Hospital; second attack with complete right hemiplegia and aphasia four months after first. Condition unchanged to time of examination: arcus senilis; sensory changes probable on the right side but difficult to test because of inability to cooperate; Wassermann negative in both antigens; blood pressure ranging between 240 and 300 over 120.

---

[1] See page 38.

Psychological examination revealed aphasia of the expressive-receptive type with no speech other than a stereotyped phrase sounding like "tutizonee" and the occasional reactive responses, "Yes'm" and "Oh Lord!" and with only little understanding of spoken language. Movements of the left hand were coordinated and fairly skillful. Apraxic disturbances would fall chiefly under ideokinetic and constructive forms. The patient could not imitate positions with the facial muscles, put out the tongue, blow out the cheeks, wink, etc. She imitated correctly for the simpler tests with the left arm, hand, fingers, and leg, but failed on many of the more difficult tests. On a second or third trial, however, she was often able to correct these failures. She used most familiar objects well and was able to carry through such a complicated action as sealing an envelope and stamping it correctly in the proper corner. On first attempts at copying figures she seemed to have a typical constructive apraxia; for instance, in copying a square, she drew four parallel vertical lines. After several demonstrations, she copied a square satisfactorily, and also a circle and a triangle, but she could not get more complicated figures and made only a series of vertical lines in copying her first name, Annie. In so far as studies could be made she gave no evidence of gross agnosic defects: she could almost always match the familiar objects and most of the colors of Head's Tests and she turned pictures right side up when they were given her in the wrong position. On non-language, as on most of the above tests her responses were extremely slow, but not as a result of lack of manual skill; she handled the blocks of the formboards and picture-boards well and tapped them into place efficiently if they got stuck. She made comparatively few errors in placing the blocks of the Seguin Formboard, and the relatively good form perception thus indicated was another sign that there were no gross visual agnosic defects. On the formboards where she had to plan for the placement of several blocks to complete one hole, she did much less well, but on the Two-Figure Board when the square was placed for her she then put the cross in correctly. She never showed any sign of solving a puzzle according to the pictorial content. She was unable to imitate any of the patterns of the Knox Cube Test, and seemed less well oriented here than in the work with the formboards. This difficulty in imitating fits in with that noted for the apraxia tests above. In spite of the very serious aphasia, the apraxic disturbances, and the poor performances on non-language tests, there was not a general and comparable deterioration in all aspects of mental functioning. In practical situations the patient showed some good responses. For instance, one day when the examiner picked up a can of talcum powder from a near-by table and gave it to her to use, she refused to do so in spite of repeated urging. Finally she pushed herself away and down the ward several beds, and pointed to a table there, indicating her belongings. She would not use the powder which belonged to some other patient, and found a satisfactory way of explaining her refusal. On the whole she was friendly, and after several days' work she became much more responsive and even amused at some of her unexpected difficulties, such as in imitating finger positions.

J.D., white, male, 55; bundle man for newspaper; 6 grades; right handed. Admitted to the psychiatric ward of the Philadelphia General Hospital in a confused state which had lasted two months. Disoriented for time and place; speech slurred and usually unintelligible; apraxic. Physical and neurological examinations negative except for Argyll-Robertson pupils, tremor of tongue, and increased knee jerks. Serology and x-ray examinations negative. Mental condition much improved in third month when he was taken home by his family; apraxia disappearing.

Two months after admission speech was infrequent and fragmentary; it was sometimes incoherent and sometimes muttered too low to be intelligible. The patient had no difficulty naming familiar objects or colors, pointing to these at oral or printed command, or understanding simple questions. He could repeat sentences of as long as twenty syllables correctly. He could not carry through language intelligence tests such as giving opposites. His writing was more seriously affected than his speech. Spontaneous writing, except for his name, was almost incomprehensible. In all forms of writing, even in copying, words and letters were misformed. The letter misformations appeared particularly as perseverations, with extra loops on "m's" and "n's." The most striking disturbance two months after admission was the apraxia, which would be classified as of the ideational type. The patient was unable to care for himself. When he tried to dress, he would attempt to put both shoes on the same foot or draw on his socks over his shoes. He could still carry through some relatively simple actions, such as buttoning buttons, pinning with a safety-pin, and cutting with scissors, but he failed on others. He did not uncap a fountain-pen before using, and when he saw no mark on the paper, he shook the pen and then opened the filling lever in an attempt to get out some ink. Until after several demonstrations he was completely disoriented in lighting a cigarette, holding the cigarette to the box as if the latter were a lighter and then striking the cigarette on the box. When given a lighted match, he at first put it in his mouth and burned himself. His drawing was very poor but he could copy simple geometrical figures. The apraxic disturbances were probably present before examination but they disappeared rapidly thereafter, and appeared in marked form only on the first two or three trials. There were never gross agnosic defects in the auditory or visual fields, and tests here and for right-left orientation were performed as well as could be expected in view of the mental deterioration.

J.M., male, Negro, 34; education unknown; garage man and car washer; right handed. Admitted to the Philadelphia General Hospital disoriented, confused, and somewhat stuporous, with right hemiparesis, aphasia, apraxia, and evidences of increased intracranial pressure and lues. Except for slight flattening of right side of mouth and hyperactive biceps and patellar reflexes on the right, the condition cleared up in about two months. Received antiluetic treatment while in the hospital.

Psychological examination made during the third and fourth weeks in the hospital showed disorientation for time and place, incoherent speech with frequent verbal confusions, and garbled words in naming objects. There were evidences that he recognized some single letters and understood many single familiar words, but coherent responses to longer printed or longer spoken directions could not be obtained. During these two weeks the patient's writing was never more than a scrawl with either right or left hand; no letter forms were recognizable either in spontaneous writing or copying. Apraxic defects fell under the ideational type. The patient could perform simple movements at command or by imitation, and he was not awkward in his motor behavior with either hand. He seemed to recognize most objects and could name some of them, but had difficulty in carrying out complex actions such as using a fountain-pen, lighting a cigarette, or enclosing a letter in an envelope and sealing and stamping the envelope. He unscrewed the cap from the fountain-pen, but continued to unscrew without taking it off after it was loose. Given a cigarette and a paper of matches he put the cigarette in his mouth and drew on it without having lighted it. When the examiner opened the paper of matches for him he tried to tear one off but, failing on his first attempt, struck his thumb again and again on the striker. Finally, given an unlighted match he put it to the cigarette without striking and lighting it. Tests showed that his recognition of objects, pictures, colors, coins, and persons was satisfactory, and there did not appear to be gross agnosic defects in the auditory field. Satisfactory conclusions could not be drawn from the finer tests because of the mental deterioration.

J.N., male, white, 60; boxer, later a cigar maker; 4 or 5 grades of school; right handed but because of his trades probably fairly skilled in the use of both. First attack with left hemiplegia and disturbance of vision three years before admission to the Philadelphia General Hospital; second with less marked hemiplegia on the right one year before admission. On admission found to show partial disorientation; emotionalism; left hemiplegia with spasticity and right hemiparesis with lessened tonus; sensory disturbances on the left, the extent of which was impossible to estimate because of the patient's inability to cooperate; negative Wassermann in both antigens. At the time of the examination four years later, the condition neurologically was essentially unchanged except that no sensory disturbances were demonstrable. Symptoms of pseudo-bulbar palsy were noted.

Psychological examinations showed slow speech with unnatural effort at precision; spontaneous speech was rambling and repetitious. He understood questions and simple directions fairly well, but evaded attempts to determine his understanding by more difficult tests. Reading tests, similarly, were fruitless for he complained that he was unable to see in spite of the fact that the glasses he had been given brought his visual acuity up to normal. He was willing to try to write with his right hand and tests showed his writing badly disturbed, both in point of word- and of letter-formation, and particularly toward the end of the word.

The apraxic disturbances appeared largely in drawing, in copying, and in performances such as dealing cards which required definite spatial arrangement. He was able to carry through actions such as lighting a pipe without trouble, and in many of these he used his left hand satisfactorily to hold the object he was about to manipulate with the right. His drawing of a square to command had four corners but was rather like a diamond than a square. He could copy a square but not a triangle or a diamond. He knew that his attempts were bad but could not improve them on repeated trials. When he copied figures, forms or parts of forms sometimes perseverated through several responses. He showed no gross agnosic defects in recognizing sounds, objects, pictures, or colors. His general mental state had apparently improved since his admission to the hospital, for at the time of the examination he was oriented for time, place, and person and able to talk coherently about the everyday affairs within his range. Undoubtedly personality changes still persisted, however, and he was childish and very boastful.

In all five cases the apraxic and agnosic disturbances appeared in very complex disorders. In two there was general disorientation and mental confusion, in another definite personality changes with an earlier report of partial disorientation. In the remaining two, the aphasia was extremely severe and the mental deterioration was great, although not enough to explain the apraxic and agnosic phenomena. In the two cases where there was general disorientation, the apraxic disturbances appeared only at the time of the greatest mental confusion. The lesions were apparently extensive in the other three cases; in two there was a history of two attacks, and in one of these the lesion was bilateral. It must be noted not only that apraxic and agnosic disturbances appeared in these complex pictures, but that they did not appear in the sixty clear-cut aphasia cases or in the thirty-eight control cases of unilateral cerebral lesion without aphasia. In other words, the findings as a whole go to show that apraxia and agnosia appear with extensive disorders and extensive pathology.

Among the five cases there were disturbances which could be characterized as ideokinetic and ideational apraxia, but none typical of the so-called limbkinetic form. In one case the difficulties seemed closest to the so-called constructive form. Agnosic disturbances were present in two cases, but in neither were they more marked than the apraxic. One of these cases, the patient A.G. reported in Section 2, is a good example of the close relationship of apraxic and agnosic phenomena.

2. A CASE SHOWING APHASIA, APRAXIA, AND AGNOSIA: A.G.

Among the five cases, A.G., a Negro woman of 66 years, was the most satisfactory for detailed study. She showed relatively severe apraxia and agnosia, which had persisted during the two years between the onset and the first examination and which were unchanged on a second examination eight months after the first. She was oriented and cooperative and therefore easier to study for changes in movement and perception than the patients whose apraxia and agnosia appeared in a state of general mental disorientation.

Her case is reported in considerable detail as an illustration of the examination methods used in studying apraxia and agnosia.[2] Because of the severe aphasia, however, certain tests were impossible, for example, tests for the so-called amnesic apraxia; she could not understand well enough to carry out movements to oral command or to show how she would use objects when the objects themselves were not given her. Furthermore, the nature of the case limited the study in another way: the patient was completely paralyzed on the right side so that there was no possibility of comparing movements on one side with those on the other.

A.G. *A case of severe aphasia of the expressive-receptive type, with apraxia and agnosia. The lesion was thrombotic, involving the distribution of the left anterior and middle cerebral arteries.*

Female, Negro, 66; housework by the day; education unknown; probably right handed.

Psychological Summary

The aphasia was severe affecting both expressive and receptive processes. The patient's spontaneous speech was limited to meaningless syllables and the phrase "Good evening," which had no propositional value. Inferior speech responses were more extensive: she sometimes used a word or phrase in answer to questions; she had some success with automatic word series and she could recite a prayer and sing a hymn fairly well. Her understanding of spoken language was not quite so limited as her spontaneous speaking, but at best she grasped only a few words or very simple questions. She seemed to recognize some words in print but her writing was a scrawl in which no letter forms were apparent.

---

[2] In order to show the typical examinations for apraxia and agnosia, they have been discussed in a separate section from the non-language tests of the battery used in this research. Actually there is considerable overlapping and many of the tests now included in the apraxia-agnosia group are valuable indices of mental functioning in the non-language field. The problems involved here are discussed in Section 3 of this chapter.

She showed both apraxic and agnosic defects, and the hospital findings indicated that her difficulties in the recognition and manipulation of familiar objects had not changed during the two years between the attack and the first examination. The picture as a whole was unchanged on a second examination made eight months after the first. Disturbances in movement were more prominent than in perception, but both were obviously factors and neither could be isolated. The case could not be assigned exclusively to any one of the classical types of apraxia. So-called limbkinetic disturbances, however, could be ruled out; the patient's movements were coordinated and fairly skillful. From the point of view of apraxia her difficulties lay in initiating the proper movement and following it through correctly. She had difficulty and made many errors in imitating movements of the face and of the left arm and hand. Her behavior with objects was disturbed by an agnosia but it was often apparent that she recognized the object and yet could not carry through the behavior necessary in using it correctly. Following the usual classification, it may be said that she showed both ideokinetic and ideational apraxia. The disturbances in "constructive" behavior, for example, in copying patterns made by small sticks, were less marked than the other apraxic phenomena, so that the case would not be said to be an example of constructive apraxia. These disturbances were present, however, and appeared in more marked form on some of the drawing tests, which also revealed the ideokinetic factors, and on some of the formboards.

Agnosic disturbances were complicated and appeared in the recognition of geometrical forms, objects, pictures, and colors by sight and in the recognition of objects by touch. The extent of the disturbance in the auditory sphere could not be determined because of the severe aphasia and mental deterioration, but the patient obviously recognized many familiar sounds.

She was extremely cooperative and was able to work steadily for an hour or more without signs of fatigue. She had some ability to criticize her performances; for example, in laying out sticks to match a given design, she would sometimes shake her head and look very sad when unable to construct the pattern correctly. From general observations of her behavior it was apparent that she understood concrete situations fairly well. While in the examining room working, she would judge the approximate time of the dinner hour, possibly from the increased activity in the hall, and give unmistakable signs of wanting to go back to the ward. Another good reaction occurred one day when the examiner closed the door, saying, "It's too cold"; the patient pointed to the open window and jabbered to show another means of dealing with the situation. She always recognized the examiner, even after an interval of eight months, jabbered some greeting, and tried to move her chair out into the aisle in preparation for the trip to the examining room.

Neurological Summary

According to the history, three months prior to admission to the Philadelphia General Hospital the patient's right leg became progressively weaker until she was chairfast. A constant tremor of the right leg developed. Five weeks before admission, without losing consciousness, she suddenly developed loss of power in the right lower face and right arm with inability to speak.

Examination on admission showed a complete right hemiplegia. The right limbs were spastic with increase of all reflexes but no Babinski. The pupils were irregular and did not respond well to light. There was a marked arcus senilis. There was a questionable right hemianopsia, and at first a disturbance of sensation on the involved side seemed probable.

Further examination showed that she had a marked generalized arteriosclerosis, with blood pressure ranging between 280 and 300 over 130. Ophthalmoscopic examination showed a distinct arteriosclerosis. Spinal puncture was negative and the Wassermann was negative in both the fluid and blood.

The patient improved somewhat, that is, she became clearer, and about two years after the attack it was possible to demonstrate that there was no disturbance of sensation or of the visual field. The aphasia remained severe and the patient also showed definite apraxia and agnosia: she was unable to carry out many simple movements to command or by imitation and she often failed to recognize or show the proper use of familiar objects.

During the psychological examinations, which were made three years after the onset, and again three years and eight months after, frequent uncontrolled laughter was noticed. She never had spells of laughing or crying when sitting by herself, but during the examinations she would work quietly for a while and then break into sudden laughter which did not depend on any change in the external situation. She did not have pseudobulbar palsy.

Five years and eight months after the onset, and two years after the last psychological study, the patient began to have convulsive movements and attacks of Cheynes-Stokes respiration. Two days later she died. Autopsy showed hypertrophy and dilatation of the heart; coronary atherosclerosis; hypostatic bronchopneumonia; nephrosclerosis; and severe aortic sclerosis. The brain weighed 850 grams. The left hemisphere was small and collapsed as the result of an old vascular lesion. The lateral surface showed complete degeneration and collapse from the frontal pole to the parieto-occipital region. The temporal lobe and the occipital lobe were not involved. The mesial and orbital surfaces also were normal.

The writers are indebted to the Department of Neuropathology of the Philadelphia General Hospital for the further report which follows:

> There is an old thrombotic lesion of the left hemisphere involving the distribution of the anterior and middle cerebral arteries. The Sylvian artery and the branches coming off from it are converted into a thick mass of cholesterol crystals. There is no lesion of the occipital lobe. On the mesial surface the anterior three quarters of the corpus callosum are degenerated. The condition of the middle cerebral artery points to sudden complete occlusion without the establishment of collateral circulation. The brain lipoids are the source of the cholesterol which fills the lumen of the vessels.

Psychological Report

Speaking. There was a marked difference between *spontaneous speaking* and lower forms of speech response. Spontaneously she could utter only a series of meaningless syllables or the phrase "Good evening!" which had no more significance than the syllables had. The syllables themselves were not actually stereotyped but consisted mostly of the sound combinations "wa," "wye," "pa," "pye," "bye," "me," "ma," "dye." Usually only one or two of these were to be found in any one response, and she would say, for instance: "pye, pye, pye, pa, pye!" The jabbering of this kind was loud and clear, and uttered with a great deal of emphasis.

In answer to questions, she often used the true words, "Yes'm" or "No'm," but not always in the sense she intended. When she made a mistake of this kind, she frequently corrected it.

Her *reactive speech* was slightly more extensive. She almost always said "Good-bye" when the examiner left. She could say "What?" when she did not understand, and "Oh, yeah" when understanding suddenly came to her. Asked if she were tired, she once said very clearly: "No, no indeed."

In giving *automatic word series* she was able to achieve much longer and more varied speech utterances than by any other means. She could not start a series at command; the first item had to be pronounced for her. Given "one two," she could always count through ten, but her words were somewhat slurred. Started on "Monday," she could say many of the names of the days of the week but not all. Her best response was: "Tuesday, Frenday, Friday, Seddy, Sunday—Monday, Tuesday, Wensday, Friday, Friday." Started on "January," she could give only one or two of the names of the months and if these were attempted after the days of the week, perseverated with the latter. When the examiner said "a b," she understood immediately what she was supposed to do, but could say only a few of the letters, and mixed these in with the typical syllables of her spontaneous speech.

It was well known around the hospital that the patient could say a prayer and sing a hymn, and she was frequently called on by other patients or nurses to do these stunts. The words of the prayer were not all clear and she sometimes broke down after the second line and had to be prompted. It was interesting to find that she occasionally made spontaneous corrections in her performance. For example in the attempt recorded below she apparently thought the last lines poor, tried the last one again, and then repeated the last two clearly:

(Say "Now I lay me—.")
Now I lay me down to teep
Pay de Lord my tould to teep
If I wait my toul to keep . . .
(If I die—) fore I wate
Tole de Lor de tul I take . . .
I pay to the Lord my sould to take . . .
If I should die before I wake,
I pray to de Lord my toul de take.

The hymn she could sing was "Nearer My God to Thee." The tune was recognizable and the words about as well articulated as those of the prayer.

Naming. A.G. was unable to name objects, pictures, or colors. From the syllables she uttered when these were presented, there were no indications that she was attempting the correct names. She was able to pick out a number of objects correctly to oral command, but few from the printed names. She made only two errors in the first eighteen trials with the objects of Head's Test at oral command. When wrong names were suggested for familiar objects, she usually rejected them and then, when the right one was given, showed by smiling and nodding that she recognized it. She was less successful in recognizing names for the line drawings of the Kuhlmann Test or for colors.

Repeating. A.G. uttered more speech sounds in repeating than in any other speech response except automatic word series. She could repeat a number of single words, for instance, the names of familiar objects or colors, but her articulation was often poor and there were errors such as "kizzers" for "scissors" and "faif, er fife" for "knife." She succeeded in repeating some short familiar phrases like "Hello" or "Good morning," but she never got longer phrases and even with the short ones she made errors, sometimes through perseveration.

Understanding spoken language. That the patient understood some familiar words was demonstrated by the Object-Naming Test. Apparently, however, the fact that the objects were laid out before her helped here, and she was less likely to understand single words without this aid. On the Gates Word, Phrase, and Sentence Reading Test, given orally, she understood the single words and could indicate the correct picture to illustrate them, but not the phrases or sentences. She understood some simple questions, particularly if they arose naturally from the situation. Because of the apraxia it was impossible to test her understanding by oral directions; she was rarely able to follow any of these.

Reading. The patient could not pronounce any letter or word, but her responses on the Object-Naming Test showed that she understood a few printed words.

Writing. She was unable to write anything more than a scrawl; no letters were distinguishable.

Special studies for apraxia and agnosia. A.G.'s paralyzed right arm rested in her lap, the fingers contracted in the typical hemiplegic manner. She did not use it at all. Her left hand showed no ataxia and usually no noticeable awkwardness beyond that natural for the unskilled hand. For example, she grasped and moved objects normally. When she had to hold a box or test object on her lap, she never let it slip. On the Form Discrimination Test of the Stanford Binet Scale, she held each small card very efficiently while she looked for a form to match it.

She could carry through few *movements at oral command,* but the difficulty could not be taken as an index of apraxia because of her poor understanding. She was more successful in *imitating movements,* but showed severe apraxia for many movements of the face and left arm and hand. Typical responses to the series of tests used are as follows:

Movement to be imitated	*Patient's behavior*
Eyes closed	+
Tongue out	Pulls at mouth. She was never able to put out tongue at command or by imitation

Movement to be imitated	*Patient's behavior*
Cheeks blown out	Sucking movements or purses lips but never blows out cheeks
Lips protruded	Usually +. This is a frequent trick of hers, however
Upper teeth on lower lip	Presses lips hard together
Tongue out and on upper lip	Protrudes lips
Tongue behind upper front teeth	Opens mouth wide several times, once putting tongue out a little way
Lips pressed together	Usually +
Tongue just under upper lip	Presses lips together
Tongue run from one side to another just under upper teeth	Always a failure, usually opens mouth
Whistle	Works with lips; no sound
Cough	Works mouth, but cannot cough
Sigh	Works mouth again; repeated attempts but cannot sigh
Deep breath	—
Yawn	—
Wink	Often closes both eyes and then opens one, but can sometimes close left alone
Pointing to left ear	Clutches at right cheek and then touches right ear
Pointing to right eye	First time makes circle of thumb and forefinger and loops it over nose (serious response). Sometimes points to eye, either left or right
Back of hand on mouth	Usually —
Patting top of head	Puts hand to head but pulls at her hair

Movement to be imitated	*Patient's behavior*
Raising arm	Usually +
Patting paralyzed with non-paralyzed hand	—. Goes through all sorts of motions with left hand, pulling at dress, clenching fist, etc.
Clasping hands	Picks up right, sometimes by wrist but sometimes correctly and clasps
Crossing arms	+. Lifts right arm and puts left across it
Snapping fingers	Closes and opens fist or rubs fingers together
Spreading fingers	Sometimes simply holds out hands, sometimes then spreads fingers
Extending thumb, fingers closed	Holds out fist, puts thumb between fore and middle fingers, points to examiner's thumb, etc. Sometimes can repeat after her hand has been put into position
Extending forefinger alone	+
Little finger extended, rest closed	Usually extends one other finger. Hand put in position for her, she may hold it next to examiner's as if to check. Fixes right hand in her lap with little finger extended. After demonstration sometimes makes purposeful attempt with left and succeeds
Middle finger extended alone	Makes great effort but holds up fore and little fingers. Hand put in position for her she can usually repeat after a few minutes' interval
Ring finger alone	Attempts usually result in extension of both ring and little
Touching thumb and little finger	No success until her hand is put in position and then she can usually repeat after as long as a minute

Movement to be imitated	*Patient's behavior*
Touching thumb and middle finger	Usually no success; touches some other finger or makes a fist. Hand put in position, she is not much more successful in repeating
Touching thumb and ring finger	Usually touches some other finger and will accept as correct
Touching fore and little fingers	Fails, and fails after hand put in position for her
Waving good-bye	Usually does so after considerable demonstration
Throwing a kiss	Sometimes does not make pertinent motions at all. If she does, still not correct. For example, kisses fist and uncloses fist as she gestures out
Threatening with clenched fist	Goes through motions with hand and arm correctly but usually laughing
Lifting and revolving leg	+
Kicking object out of way	Not bad in view of fact that she is chairfast
Rolling cylindrical carton up gradual slope	+
Bending trunk forward	+
Bending trunk to right or left	Imitates to opposite side when facing examiner
Bending trunk forward and swinging around to either side	Can swing, but usually to opposite side when facing examiner

According to the classical differentiations the disturbances found here were largely ideokinetic. So far as could be judged in the paralyzed condition, they appeared in movements of the face, hand, and arm but not of the trunk or leg. It must be noted, however, that disturbances are always more likely to be apparent in movements of the face, arm, and especially the hand, where finer responses can be tested. Disturbances characterized some of the so-called expressive movements as well as other types. They varied to a certain extent from time to time: there were some movements such as putting out her tongue which she could never get and others such as extending her forefinger which she practically always got; in between, however, there were many which she sometimes had more or less success with but rarely carried through perfectly. Her attempts were usually but not always closely related to the movements required. For example, on the finger tests her movements were mostly confined to the fingers.

In *copying patterns made by small sticks* as in tests of the so-called constructive apraxia, the patient did fairly well, indicating that the principal factor in her disorder was not a difficulty in the appreciation and manipulation of spatial relationships.[3] She made several errors at first, the worst of which is reproduced in Figure 18, A (page 354). Her second trial especially is characteristic of "constructive apraxia." As the test progressed, however, she clearly improved and succeeded in reproducing many of the more difficult items, two of which are presented in Figure 18, B and C. Her improvement showed that judgment as to these problems in construction should not be based on a small number of test items. Her behavior was interesting from the point of view of the nature of the performances required. She worked slowly, looking from her construction back to the model again and again. Perceptual factors seemed to be of great importance. She sometimes failed on a first trial and succeeded in correcting her figure spontaneously. Once or twice, however, she shook her head to indicate that the figure was wrong but she could not correct it. On the first trials, whatever the number of sticks required in the figure (three to eight), she was always given a pile of ten. If she were not able to make the figure, she was then given just the number of sticks necessary for it, and this restriction led to greater success.

Both the imitation tests and these problems in construction would of course reflect disturbances of either motor or perceptual character, and the relative influence of each would be hard to differentiate. On the next tests to be described, the matching of geometrical forms, objects, pictures, and colors, perceptual disturbances stood out more clearly.[4]

On the *Form Discrimination Test* of the Stanford Binet Scale where she had to point to that one of ten geometrical forms corresponding to the one shown her, the patient succeeded for only about five. There was no regularity in her performance and she did not match the simpler forms, like a circle or a square, and fail with the more difficult polygons. Her responses did not indicate so satisfactory an appreciation of geometrical forms as that shown by the construction test described above. The difference may be attributable to the fact that the Form Discrimination Test was not continued for so long a time, nor was it repeated. In other words she had not such a good chance to adapt to the situation or to learn the forms.

---

[3] These tests are always supplemented in apraxia studies by drawing tests, and a variety of drawing tests were made in this case. They are all reported together in the section on the non-language performances which follows. The drawing tests showed signs of ideokinetic apraxia, and also, together with some of the formboards, indicated more serious disturbances in "constructive behavior" than the tests of imitating patterns made by sticks. In other words, the drawing tests and others of the non-language battery extended this study of constructive behavior.

[4] These tests are of course only gross indices. No tachistoscopic studies of visual perception were done because of the patient's severe and extensive disorder.

Asked to *match objects,* that is, to select the object in the group of the Head Object-Naming Test which corresponded to the one shown her, she was immediately successful for only four or five of the eighteen items. On the second or third trial, i.e., after her first or first two responses had been rejected by the examiner, she usually succeeded with another four or five items. Her difficulty did not seem to be one of understanding the problem, but an actual failure to differentiate between the objects. She seemed to be somewhat less accurate in matching objects than in pointing to objects at oral command.

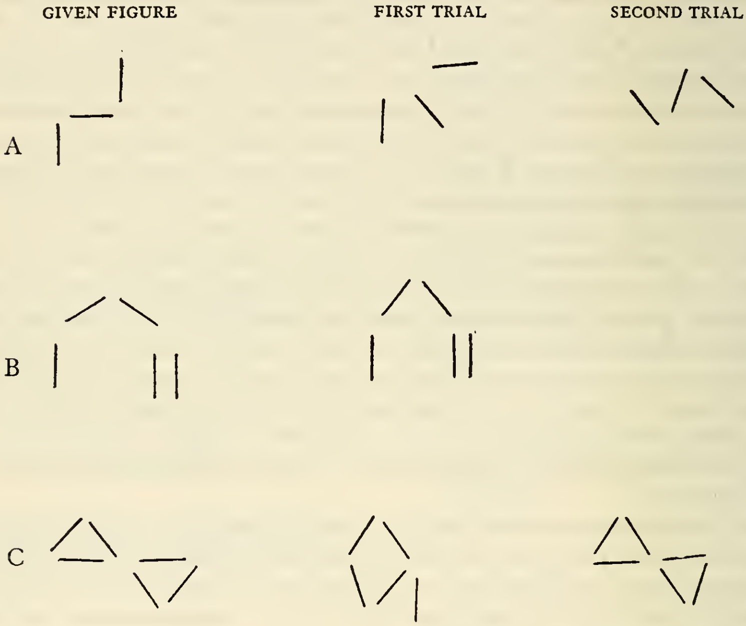


Figure 18. Attempts to copy figures made of small sticks: Case A.G.

By using two sets of the Kuhlmann Line Drawings, it was determined that she had about as much difficulty *matching pictures* of objects as matching objects. When these drawings were presented to her one after the other, some of them upside down, she turned all but one of the latter, the bed; that is, whatever the position they were given in, she held all but the picture of the bed correctly as she looked. When the more complicated pictures of the Stanford Binet Scale were used, and two of the four handed to her upside down, she turned these two immediately. It was thus clear that even such complicated pictures had some meaning for her.

In *matching colors* she was usually successful with the black, blue, green, and yellow, but made frequent errors with the others of Head's Test.

She had about as much success in *matching objects by touch* as by sight. Again her difficulties did not seem to be in understanding the problem. She would feel the object for some seconds in her left hand, look over the row of objects that lay before her, and then make such errors as selecting the key after she had felt the matches, or the scissors after she had felt the closed penknife.

Tests for *sound recognition* were not so easy to administer in this case as those for sight or touch recognition. They require a higher level of intelligent response, for the patient cannot point out the sound, but must either identify it in a temporal sequence or make it herself after selecting the correct materials from those laid out on a table before her. This patient showed that she had at least a certain amount of sound recognition, for she could reproduce the simplest of the sounds made for her behind a screen, ringing the bell to identify that sound, for instance, or pointing to the comb to show that the noise had been made by running the fingers along the teeth. On the whole, it seems probable that her sound recognitions were at least as satisfactory as her visual or tactile recognitions.

The patient showed great difficulty in the *manipulation of objects,* but it was not a general difficulty with all objects. She could feed herself quickly and efficiently, using a spoon almost entirely. When asked to try a fork, she used this as a spoon. She had no difficulty raising her cup to her lips and drinking, and when tested also showed herself able to fill a spoon with liquid and raise that to her mouth satisfactorily. Asked during the course of a meal to use a salt cellar, she said "No, no!" Urged further, she spilled a little salt on the side of her plate, apparently taking great care not to get any of it on her food. On the whole she showed far more discrimination with regard to all the apparatus of eating than for any other objects. She neither dressed nor undressed herself, but the extent of her paralysis would have made dressing difficult in any case. She was able to blow her nose fairly naturally, fold her handkerchief, and put it back in her lap under the blanket.

These performances represented her most normal behavior with objects. Other actions showed that she had difficulty both in recognizing the object and in manipulating it. Given a brush or a comb, she would grasp either fairly well and put it to her head, but she was just as likely to use the wrong side as the right. When she did hold the comb with the teeth down, she used it in such a way as to smooth the hair with the hand rather than to draw the comb through. Given a tooth-brush, she was likely to put it to her hair, even if she had not used a comb or brush before in the test period. If she hesitated about what to do with the tooth-brush and it were raised to her hair, she always accepted the suggestion and used the tooth-brush as a hair-brush. If, however, it were not simply raised to her face but actually put into her mouth, she went through the motions of brushing her teeth fairly well. This behavior alone would seem to indicate that her greatest difficulty was in recognizing the object rather than in manipulating it correctly, but other tests showed difficulty in the manipulation when the recognition itself seemed fairly satisfactory. In other words, it was sometimes agnosic and sometimes apraxic disturbances which were in the foreground.

She always recognized the use of a safety-pin immediately and was able to pin two pieces of cloth together with it. Her performance was not markedly clumsy, and she was always careful to raise the cloth and push up so as to get the point of the pin out again. She did not always close the pin unless specially directed to do so. She was able to button buttons slowly but efficiently.

Given objects less familiar in her particular restricted environment, she responded as follows:

Scissors: Opens the scissors without putting fingers into the rings in the usual way, and presses one or both of the points on the paper held out for her to cut, thus carrying the paper down to the table. Then inserts thumb and forefinger in rings and presses down on the paper again, making holes. Each time paper is held up, she presses it down. Paper finally inserted between the blades of her scissors. Does not close them firmly enough to cut the paper, but pushes against it and seems satisfied when it tears. (This is a typical performance, repeated with slight modifications many times.)

Pencil: Grasps pencil well but often tries to use it wrong end down. Usually reverses spontaneously.

Whisk-broom: Waves it in air until examiner holds out arm; then uses whisk well to brush off coat sleeves.

Fan (open, not collapsible type): Picks it up by the fan part instead of the handle and uses it upside down. When it is put in her hand correctly, fans well with it.

With objects which required a more complicated sequence of movements for correct use, many of her performances showed definite apraxia of the ideational type.

Using fountain-pen: Grasps pen normally but attempts to use it without uncapping. Usually shows no dissatisfaction with this procedure. When examiner demonstrates how cap should be removed, and she is asked to try again, she attempts to pull the cap off, first by her left hand alone and then by her teeth. After several demonstrations, she still does not try to unscrew it.

Pouring water from pitcher to cup: Easily done without hesitation and without spilling.

Winding thread on spool: Given an empty spool and about two yards of stout string, seems to understand immediately that she is to wind the thread on the spool. With the left hand alone manages very efficiently to get the first two or three coils on. Then holding one end of the spool in the left hand and pressing the other against her breast, winds the rest of the thread on loosely but well.

Lighting and blowing out match: Until after repeated commands makes no move to open the matchbox which was put in her hand; then does not take out a match until after further commands. Told to light the match, strikes the head repeatedly but awkwardly against the *top* of the box. With the side of the box held up for her, she strikes the match and gets it lit. So that she would not burn herself, the examiner then took the lighted match and held it up before her, telling her to blow it out. She is unable to do so, but makes several almost frantic attempts which result in a little puff and the sounds, "petty." Obviously worries that she will not be able to get the match out before it burns examiner's fingers.

NON-LANGUAGE PERFORMANCES. The performances on the formboards of the Shorter Pintner Performance Scale are of great interest as examples of the behavior which is possible when various factors such as the ability to discriminate and manipulate geometrical forms were seriously disturbed. On the *Seguin Formboard,* where she was given three successive trials at putting the ten large geometrical forms into the corresponding holes, she showed definite improvement on the second trial, with a decrease in the time required from 160 to 80 seconds. The third trial required 125 seconds. Her behavior seemed to be almost entirely by trial and error. In only eight of the thirty placements in the three trials together did she put the block directly in the proper hole. These correct placements were mostly toward the end of the trial when she had all but two or three blocks in; they did not seem to be the result of more accurate recognition of any particular block. The longer time on the third trial than on the second resulted from her great difficulty with two of the placements there. She made thirteen attempts to place the diamond before she got it in correctly, and her final success seemed to be the result of chance. On the other difficult placement, however, it seemed possible that she finally recognized the correct hole and put the figure in it purposefully; she tried the circle in the square, the hexagon, the oval, the rectangle, the square, the semicircle, the triangle, and the rectangle, said "Oh my," stopped, and then put it directly in the circular hole. Two general characteristics of the performance were noteworthy: she continued with the block she had picked up until she finally got it placed, and she often revolved a block above the hole and so tried it in all possible positions.

The *Two-Figure Board,* which she was unable to complete, and the *Healy A Puzzle* showed the same preponderance of trial-and-error behavior. As opposed to the Seguin Formboard, these required a more difficult adjustment because she had to plan the arrangement of several blocks to fill one hole. Again there were some evidences of purposive behavior. Her performance on the Healy A Puzzle was below the lower quartiles of the normal group in both speed and quality scores but still well within the normal ranges. Taken alone, it would indicate a much higher level than on any of the other tests. Observations show, however, that it is a test which is likely to vary widely according to chance arrangements.

The patient recognized that the *Manikin Puzzle* was supposed to represent a figure of a man, placed the head correctly, and differentiated between the arms and legs, but reversed these right and left and did not place the legs in the sockets correctly.

On the *Mare and Foal Puzzle,* where the solution depends on either form or picture discrimination or both, the patient completed the test, and fell within normal ranges, although considerably below the lower quartiles for the normal group, in both speed and quality scores. She did not seem to be guided in any way by the pictorial content of the puzzle, and her response was again largely trial and error. It was apparent, however, that within the trial-and-error behavior, there was still some system. Again when she tried a piece in a hole she usually revolved it all the way round so that, if it were the correct piece, she did not miss the placement through having tried the wrong direction.

She was unable to complete the *Ship Test* in any form, that is, to get the ten rectangular pieces of the picture in the rectangular frame regardless of the picture sequence. She was much troubled by her failure. The test seemed to present a difficulty similar to that of the Two-Figure Board, that is, she had to plan a purposeful construction of a number of blocks to fill one hole. She was able to fill in all the little squares of the *Picture Completion Test,* but seemed to make no effort to choose blocks according to the object illustrated on them. Her score was only 2, or considerably below the lower limit for the normal group.

On the *Knox Cube Test* where she had to imitate the pattern traced by the examiner on four blocks, she got only the first one, the direct one-two-three-four sequence. For the next five patterns, however, she continued to make a purposeful attempt and came very close to the correct responses. Her performance was poorer than that of any of the normal subjects, but better than that of some of the aphasic patients with severe disorders but no apraxia or agnosia. Interestingly enough, she began to count as the examiner tapped out the third pattern, but went straight ahead with the number series "1, 2, 3, 4, 5" as blocks 1, 2, 3, 4, 2 were touched.

Her attempts to *copy figures* were interesting. She could not draw a straight line as an isolated performance no matter how many times a single straight line was drawn for her or her hand was guided while she made a straight line. Her efforts consisted of irregular lines going forward and backward as in the attempt at the Porteus Maze Test illustrated in Figure 19 (opposite). When she

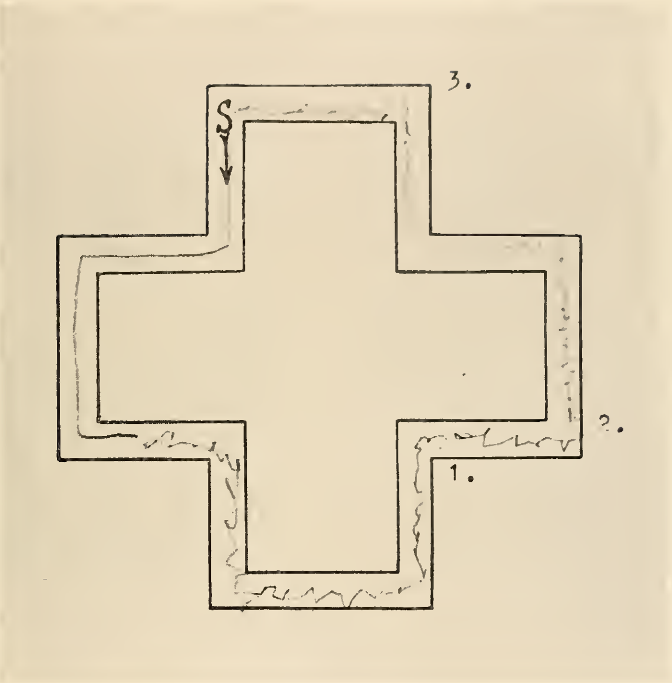
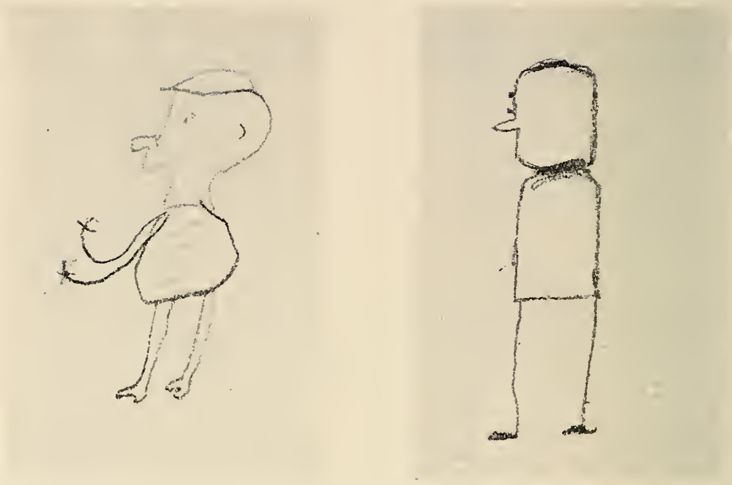


Figure 19. Attempt to trace the Porteus Maze, Year IV: Case A.G.



A B

Figure 20. Examples of poor drawings of a man made by adults of the normal group

started to copy a square, she usually began with this irregular line but made the third or fourth side straight. When she had copied a square several times, the later drawings showed straight lines on all sides. She seemed to be able to draw a straight line only when her efforts were concentrated on some larger problem, such as drawing a square. A similar situation appeared when she tried to copy a circle. She could not do so until after her hand had been guided through several circular movements, yet when she tried to draw at command, without any model, most of her scrawl consisted of circular forms. She could not make any recognizable drawings of objects from a model or at oral command. Attempts were made to get her to draw a picture of a man by drawing a primitive figure for her, but she could neither reproduce it after it had been shown to her for a short time nor copy it. Again she was much troubled by her failure and looked sadly back and forth between the model and her drawing without being able to improve hers in any way.

Her attempts at the *Porteus Maze Test* were interesting because they showed the difficulty in drawing a straight line. She tried the figures for Year III, the diamond, and Year IV, the cross, several times at the first examination and again at the second examination eight months later, always with the same result. One of her attempts at the cross is shown in Figure 19. Instead of tracing a straight path between the two lines, as illustrated by the examiner in the first part of the drawing, she laboriously worked her way back and forth. Her difficulty was not an ataxia, and she was able to draw straight continuous lines, as already noted, when the line itself was not the main problem. Furthermore, her response was not a hit-or-miss performance; she was definitely working toward the goal. At points 1, 2, and 3 in the figure reproduced, she turned the paper so as to get what seemed to be a better approach, that is, to draw the line down toward her. If she were urged to hurry she made the line rapidly but in the same fashion, and the chief result of the speeding was that the back and forth strokes were now longer and more often crossed the given parallel lines. Her inability to make a straight line when her efforts were directed toward the drawing of the line itself is probably best related to the ideokinetic rather than the ideational component in the disorder.

3. DISCUSSION OF THE CONCEPTS OF APRAXIA AND AGNOSIA

Most of the disturbances included under the concepts of apraxia or agnosia appear in simple performances which are clearly affected out of all proportion to whatever mental deterioration may be present. The apraxic patient may no longer be able to grasp objects or carry through familiar actions with normal skill and dexterity, or he may be unable to make simple movements or to manipulate objects which he has used correctly and more or less mechanically all his life. Disturbances of an agnosic nature may appear in failure to recognize these objects, or in faulty recognition of colors; or the agnosic disturbances may predominate in the auditory field, so that the patient hears but fails to recognize sounds which would previously have been well known. All these simple performances are indices of mental development at certain restricted levels, but after the early years of childhood, they are within the power of all normal individuals. Cutting with scissors, for example, a performance which is often difficult for an apraxic patient, is a skill which appears normally at about the age of two years. At this age it is a good sign of mental development but beyond this age in a normal individual its presence has no significance. Its absence is therefore a convenient sign of pathological disturbance.

Some of the tests for apraxia and agnosia, however, have involved more complex performances which differentiate less clearly between the normal and abnormal. This situation was evident even in the early days and it has become increasingly marked in recent years with the determination of disturbances in "constructive" behavior. By a variety of tests, complex changes in "spatial thought" have been demonstrated and they have been related to apraxic or agnosic disturbances or both. For these complex changes it is generally agreed that no rigid lines of differentiation can be drawn between the two factors. Nor can rigid lines be drawn between the simpler and more complex disturbances in either field. Nevertheless, when the changes falling under the heading of either apraxia or agnosia are surveyed, it is apparent that the simpler disturbances appear in those familiar responses well within the power of every normal adult, while the more complex disturbances at the other end of the scale appear in performances where the normal response may be far from perfect and there is great overlapping between the normal and the abnormal groups.

The differences in the behavior of supposedly normal subjects and the degree of overlapping between normal and pathological groups were brought out clearly by the non-language studies made of all patients in this research. These studies include many tests similar to those customarily used in analyzing the more complicated forms of apraxia and agnosia, notably the drawing and the picture tests. In addition, they cover a variety of related performances so that they extend the analysis of mental functioning in non-verbal performances further than it has usually been carried. Among the tests in the battery were formboards where the patient has to recognize similarity or differences in geometrical forms, and manipulate these forms in a purposive way so as to fill in the holes in the board. There were also combined form and picture boards where the patient must work not only on the form relationships but on the pictorial content. The digit-symbol substitution tests which were included also required the recognition of forms in order to find the correct number for each geometrical figure or symbol. The battery also contained imitation tests where the patient must imitate increasingly complex series of movements which are "abstract" in Goldstein's sense.

Naturally some of the tests of the battery were easier than others, and on the easiest tests a number of normal subjects made perfect or nearly perfect scores. Even in such instances, however, the range over which the "normal" scores distributed was large and there were a number of pathological cases surpassing the poorest of the normal. An arbitrary line drawn on any one of the distributions to show the limits of normality could not be placed so as to make an absolute division between the normal and the abnormal.

A typical situation may be illustrated by the results of the test of drawing a man as scored by the Goodenough Scale, a system which makes it possible to score all drawings from very poor to very good.[5] As the following figures show, the distributions of scores for normal and pathological groups overlap greatly:

	Range of scores	*Median*	*Upper quartile*	*Lower quartile*
Normal subjects	6–49	27	35	21
Cases of right-sided cerebral lesion without aphasia	6–35	17	19	12
Aphasic patients	4–41	14	23	5

The drawings of the apraxic patients would fall at the lower end of the scale, but some of them still within the limits of the normal group. Nor would the nature of these drawings set them entirely apart. Several of the normal subjects made spatial errors, less marked but still not intrinsically different in nature from those of the so-called constructive apraxic patient.

---

[5] One point is given for each of the series of the component parts of the drawing, as the head, the trunk, the legs, fingers, etc., and the point is credited for almost any means of representation of the part in question. For example, a single line or a loop may indicate the trunk. Additional points are then credited for correctness in proportion, two-dimensional representation, firmness of line, and so forth. The scoring, however, does not directly take into account the merit of the drawing as an artistic production.

Several others started the drawing and were unable, as some of the aphasic and apraxic patients were, to complete the figure. Two of the drawings said to be complete are presented in Figure 20 (page 359) to show the serious productions of relatively low-grade but still self-supporting and supposedly "normal" adult subjects.

Unusual difficulties which normal subjects experience on any of these non-language tests are of course not to be understood as signs of apraxia and agnosia. They are the result of poor mental functioning in certain fields. They may be said to indicate a low level of intelligence in the undefined sense in which that term is frequently used, but they need not indicate a general intellectual poverty. Intelligence must apparently be conceived in the sense of several factors at least partly independent, which may vary from one individual to another in their relative prominence and which may be affected differently according to differences in pathology. At the adult level as well as in childhood there are persons who have greater difficulty in the appreciation and manipulation of spatial structures than in various linguistic performances. Whatever the basic factors involved, it is important to recognize that the disturbances which have been designated in the literature as constructive apraxia and disorders in spatial orientation and "spatial thought" are exceedingly complex and must be considered in the light of qualitative differences in mental functioning in normal persons as well as in connection with the simpler and clearer apraxic and agnosic disturbances.

These complex changes have probably seemed the more closely related to the simpler phenomena of apraxia or agnosia because they have been approached largely through the analysis of pathological cases. When the pathological cases are studied against a background of the normal, however, the tendency is rather to relate the complex changes in "spatial thought" to the similar phenomena which many normal persons show. In any case the determination of these changes requires an extended analysis of mental functioning.

It may be questioned whether these complex changes should be included under the concepts of apraxia or agnosia. The matter is one for arbitrary decision, but there is probably more to be said against their inclusion than for it. The terms "apraxia" and "agnosia" imply, and rightly, disturbances which predominate in the fields of movement and perception. The simpler defects in motor skill and coordination, in the execution of familiar movements, in the recognition of familiar objects, colors, sounds, and so forth are relatively easily assigned to one or the other of these conditions, although the difficulties in using familiar objects properly often partake of both apraxic and agnosic disturbances. Errors in drawing, in various types of construction with blocks and so forth, or in imitating complicated or unnatural movements are, however, disturbances which cannot be assigned definitely either to apraxia or to agnosia. They are comprehensible only as changes in certain aspects of mental functioning in which both the appreciation and manipulation of spatial structures are involved. Similarly, difficulty in interpreting pictures cannot be understood as a distinct agnosic defect. In short, all these complex disturbances are difficult to classify as either apraxic or agnosic, and on careful study appear to be part of an extensive series of changes in what may be called non-language intelligence.

The concepts of apraxia and agnosia are probably most useful if they are limited to defects in those movements or perceptual responses which are well within the power of every normal adult and have become highly automatic at the adult level. Apraxia would then consist of disturbances in imitating or carrying through more or less mechanical movements or in the dexterity with which these movements are made, when motor or sensory defects which would explain the disturbances are lacking. Similarly, agnosia would consist of disturbances in the recognition of familiar objects, colors, or sounds when sensory processes themselves are satisfactory. Even when the more complex disturbances are set apart for study with the whole field of non-language intelligence, however, it is impossible to define exact limits for the disorders. The problems they present are exceedingly difficult, particularly with regard to the factor of automatism in relation to the nature of the disorder. The word "automatic" itself is of somewhat doubtful significance, but there is no question that the majority of the clearest and most marked signs of apraxia and agnosia are disturbances in responses which ordinarily appear at an early age in individual development and soon become the familiar and highly "automatic" responses of everyday life. These disturbances sometimes appear out of all proportion to whatever other deterioration may have taken place, and it is then that they constitute the disorders of apraxia and agnosia.[6]

---

[6] The current concepts of apraxia and agnosia are discussed in the light of this research in Chapter XIX.

4. SUMMARY

The results of the non-language studies made of all the normal and abnormal patients in this research showed the close relationship between some of the more complex apraxic and agnosic conditions and individual difficulties and peculiarities in mental functioning in normal subjects. They indicated that these apraxic and agnosic conditions were comprehensible only through extensive studies of various aspects of mental functioning and were better considered with the totality of the changes than with the simpler disturbances in movement or perception. The terms apraxia and agnosia are probably best limited to these simpler disturbances. Apraxia would then include disturbances in imitating or carrying through more or less mechanical movements or in the dexterity with which these movements are made when motor or sensory defects are not responsible for the changes. Agnosia would be said to occur when, in the absence of sensory defects, there were disturbances in the recognition of familiar objects, colors, or sounds.

Apraxia or agnosia, as these disorders have been limited, appeared in only 5 of the 218 cases of cerebral lesion investigated in the course of this research. The records for 4 of these 5 are summarized in Section 1, and the record for the fifth is presented in some detail in Section 2 to show the methods used in studying apraxic or agnosic conditions. In all these five there were evidences of general mental disorientation or deterioration and of diffuse or extensive pathology. It is noteworthy that apraxia or agnosia was found to occur only in such cases in this research and that these disorders, as defined above, did not appear in the clear-cut cases of the aphasic or of the cerebral lesion control groups.

XV

THE COURSE OF APHASIC DISORDERS

1. Survey of the material
2. Conditions of approximate stability
3. Improvement
4. Deterioration
5. Summary

I. SURVEY OF THE MATERIAL

MOST of the cases reported in the chapters on different types of aphasia had had "long-section" studies in which repeated observations demonstrated the course of the disorder. When circumstances permitted, continued or repeated studies were always made, and there are 36 records which offer significant data on the course of the disorder. Most of these patients were examined over long periods of time, but shorter studies sufficed in a few cases because of the rapidity of the progress. The shortest examination for any patient of this group was two weeks and the longest three years, with a median of five months.

The records for the 36 cases illustrate the various conditions which occur: approximate stability, improvement, or sudden deterioration. They are grouped in Table XVI (page 366), where those of the cases reported in preceding chapters are also assigned their respective positions.

In those cases where the psychological examinations were begun only several months or even years after the onset of the aphasia, judgment as to the course of the disorder had to take into account the patients' earlier records. No one of the patients classified as stable had shown any appreciable change since the onset. Consideration of the earlier records, however, did alter the classification in the other two groups. Because they had obviously made progress since the onset, Nos. 1, 28, and 33 were placed in the group showing improvement although long-continued studies demonstrated in each case that the aphasia had reached a stable condition at the time of examination. Furthermore, in 4 of the 11 cases showing deterioration, the classification was made on the basis of the increased difficulty in speaking which had come about as a result of operation before the psychological examinations were begun. Based as they are on the history from the onset and on the results of repeated examinations, these groups are interesting for what they show as to the distribution of types of aphasia. The stable group contains 6 of the 7 cases of expressive-receptive disorder where long studies were made, and only one other case, which is of the expressive type. The group showing improvement is of very different composition, with no expressive-receptive disorder, but 14 expressive, 3 receptive, and 1 amnesic. It is clear on the one hand that the expressive-receptive cases are the most likely to be stable. It is not clear, on the other hand, what proportion of expressive, receptive, or amnesic cases are likely to improve. The distribution here shows a higher percentage of expressive cases with improvement than in the group at large—a finding which is in agreement with general opinion on the subject. The percentage of receptive cases is about the same as in the group at large, and the percentage of amnesic lower. This latter condition results from the fact that most of the amnesic patients, being tumor cases, deteriorated after operation and so were classified in the third group. The third group is actually a complex one, containing as it does cases of gradual deterioration where aphasic symptoms became increasingly marked and cases where severe depletion

TABLE XVI

DISTRIBUTION OF THIRTY-SIX CASES OF APHASIA BY THE COURSE OF THE DISORDER

	NUMBER OF CASES	CASES REPORTED IN PREVIOUS CHAPTERS
I. Approximate stability . . .	7	Nos. 15, 37
II. Improvement	18	Nos. 4, 16, 28, 31, 33, 50
III. Deterioration		
Gradual with changes after operation	2	No. 7
Sudden as a result of depletion due to pneumonia or as a result of a second attack or of operation . .	9	Nos. 6, 22, 27

or a second attack interrupted recovery, or where operation brought about a deterioration which was sometimes only temporary. This group naturally shows nothing about a type of disorder where deterioration may be most frequent.

The median ages of the patients of the stable group, of those who show improvement, and of the whole group of 36 all fall at the year 44. The group showing deterioration, with the large number of tumor cases, has a median age of 35. These findings probably do not reveal the actual importance of age in relation to stability or improvement in the disorder. Its importance is masked by the many other factors. If the group were larger and similar disorders could be selected at different ages for comparative study, the younger patients might well be expected to show the greater progress.

Similarly, the material does not lead to conclusions as to the influence of intellectual level or of education on the course of the disorder; these factors, which must operate to some extent, are hidden by prepotent factors such as the severity of the initial disorder, physiological and neurological conditions, and so forth.

Table XVII (page 368) summarizes the data for the 36 cases, showing the neurological diagnosis and the course of the disease, the type of aphasia and its course, the interval between the onset and the first examination, the period over which the examination was continued or repeated, and the patient's age. As in Table XVI, the cases are divided into three main groups: approximate stability, improvement, and deterioration. Each of these is discussed separately in the sections which follow.

2. CONDITIONS OF APPROXIMATE STABILITY

The group described as stable comprises 7 patients who showed very little change neurologically or psychologically during a median study period of eighteen months. So far as could be judged from the records, the only neurological change after the onset was the increasing spasticity in some cases which replaced the occasional earlier right-sided flaccidity. The psychological changes were confined to the acquisition of one or two words in a few cases and to the more satisfactory reaction to his illness which developed in the one patient, No. 15, who was at first difficult to manage.

It is significant that of the 7 patients of the stable group, 6 were expres-

TABLE XVII

COURSE OF THE DISORDER IN THIRTY-SIX CASES

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
				GROUP I. STABLE					
20	Vascular: right cerebral thrombosis with left hemiplegia	Severe	Stable	Expressive	Severe	Stable	2 yrs.	1 yr. 9 mos.	50
3	Vascular: left cerebral hemorrhage with right hemiplegia	Severe	Stable	Express.-Recept.	Severe	Stable	1 yr. 10 mos.	1 yr. 7 mos.	54
9	Vascular: left cerebral thrombosis with right hemiplegia	Severe	Stable	Express.-Recept.	Severe	Stable	3 mos.	1 yr. 6 mos.	42
12	Vascular: left cerebral thrombosis with right hemiplegia	Severe	Stable	Express.-Recept.	Severe	Stable	7 yrs.	9 mos.	46
15	Vascular: left cerebral thrombosis with right hemiplegia: cerebro-spinal lues	Severe	Stable	Express.-Recept.	Severe	Stable	5 yrs. 8 mos.	10 mos.	44

TABLE XVII (*cont.*)

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
				GROUP I (*cont.*)					
26	Vascular: left cerebral thrombosis with right hemiplegia	Severe	Stable	Express.-Recept.	Severe	Stable	5 mos.	11 mos.	44
37	Vascular: left cerebral thrombosis with right hemiplegia	Severe	Stable	Express.-Recept.	Severe	Stable	4 mos.	1 yr. 9 mos.	48
				GROUP II. IMPROVEMENT					
4	Vascular: left cerebral thrombosis with right hemiplegia	Severe	Improvement: gradual, slight	Expressive	Moderate	Improvement: gradual, marked	2 mos.	10 mos.	49
10	Vascular: right cerebral thrombosis with left hemiplegia	Moderate	Improvement: gradual, marked	Expressive	Moderate	Improvement: gradual, slight	5 mos.	1 yr.	57
14	Vascular: left cerebral embolism with right hemiplegia	Severe	Improvement: gradual, slight	Expressive	Severe	Improvement: gradual, slight	1 mo.	2 mos.	50

TABLE XVII (*cont.*)

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
				GROUP II (*cont.*)					
16	Vascular: encephalitis of left parietal-occipital areas	Moderate	Improvement: gradual, slight	Expressive	Severe	Improvement: rapid, marked	6 days	1 mo.	40
21	Vascular: left cerebral thrombosis with right hemiplegia	Severe	Improvement: gradual, slight	Expressive	Severe	Improvement: gradual, slight	4 mos.	3 yrs.	50
24	Vascular: left cerebral embolism with right hemiplegia	Severe	Improvement: gradual, marked	Expressive	Severe	Improvement: gradual, marked	2 wks.	2 yrs.	45
29	Vascular: multiple sclerosis with typical symptoms; attack of left cerebral thrombosis with right hemiplegia	Severe	Improvement: rapid, marked	Expressive	Severe	Improvement: rapid, marked	2 days	2 mos.	23
33	Trauma: gun-shot wound, left temporo-parietal area with right hemiplegia	Severe	Improvement: gradual, slight	Expressive	Severe	Improvement: gradual, marked	5 yrs. 3 mos.	2 yrs. 7 mos.	41

TABLE XVII (*cont.*)

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
				GROUP II (*cont.*)					
39	Vascular spasm, left middle cerebral artery in an epileptic	None		Expressive	Slight	Improvement: rapid, slight	2 days	2 mos.	13
41	Sub-arachnoid hemorrhage with right hemiplegia	Severe	Improvement: gradual, slight	Expressive	Severe	Improvement: gradual, marked	1 wk.	2 mos.	36
43	Vascular: left cerebral embolism with right hemiplegia	Severe	Improvement: gradual, slight	Expressive	Severe	Improvement: gradual, slight	1 wk.	2 mos.	44
50	Vascular: left cerebral embolism with right hemiplegia	Severe	Stable	Expressive	Severe	Improvement: gradual, slight	1 wk.	1 mo.	33
51	Trauma: left temporo-parietal skull fracture; temporal decompression with removal of extradural clot	Severe	Improvement: rapid, marked	Expressive	Severe	Improvement: rapid, marked	3 days	2 wks.	28

TABLE XVII (*cont.*)

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
				GROUP II (*cont.*)					
53	Vascular: left cerebral thrombosis; cerebro-spinal lues	Moderate	Stable	Expressive	Severe	Improvement: rapid, marked	6 days	2 mos.	44
1	Vascular: left cerebral thrombosis with right hemiplegia and right homonymous hemianopsia	Severe	Improvement: gradual, marked	Receptive	Severe	Improvement: gradual, slight	2 yrs. 7 mos.	2 yrs. 9 mos.	44
28	Vascular: left cerebral hemorrhage with right hemiplegia	Severe	Improvement: gradual, slight	Receptive	Severe	Improvement: gradual, marked	2 yrs. 9 mos.	5 mos.	44
31	Vascular: left cerebral thrombosis with few symptoms	Slight	Improvement: gradual, slight	Receptive	Severe	Improvement: gradual, marked	2 mos.	1 yr. 9 mos.	57
47	Tumor: abscess in the left temporal lobe, drained	Slight	Improvement: rapid, slight	Amnesic	Moderate	Improvement: rapid, slight	4 days	1 mo. 1 wk.	12

TABLE XVII (*cont.*)

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
				GROUP III. DETERIORATION					
7	Tumor: large infiltrating glioma, astrocytoma, involving lower half of pre- and postcentral gyri, almost the whole temporal lobe and white matter around inferior and posterior horns of ventricle on left side	Severe	Deterioration: gradual, slight	Amnesic	Moderate	Deterioration: gradual, slight; with further deterioration after operation	5–10 yrs.	2 yrs. 2 mos.	35
18	Tumor: large gliomatous cyst in left fronto-temporo-parietal lobes which was repeatedly tapped	Moderate	Variation according to condition of cyst	Amnesic	Slight	Deterioration with some improvement after tapping cyst and after removal of tumor	1 yr. 9 mos.	2 mos.	32
6	Vascular: left cerebral thrombosis with right hemiplegia	Moderate	Gradual, slight improvement followed by second deterioration and further slight improvement	Expressive	Slight	Sudden deterioration as a result of debilitation during pneumonia with subsequent improvement	3 wks.	4 mos.	59

TABLE XVII (*cont.*)

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
GROUP III (*cont.*)									
34	Tumor: calcified tubercular tumor, left mesencephalon	Moderate	Sudden, marked deterioration after operation with subsequent improvement	Expressive	Slight	Sudden deterioration after operation with gradual post-operative improvement	1 mo.	8 mos.	27
48	Tumor: large left fronto-parietal meningeal fibroblastoma	Moderate	Sudden, marked deterioration after operation with subsequent slight improvement	Expressive	Slight	Sudden deterioration after operation with gradual post-operative improvement	1 yr. 2 mos.	1 mo.	32
22	Vascular: left cerebral thrombosis with very few symptoms	Slight	Improvement: gradual, slight	Receptive	Moderate	Improvement with sudden deterioration after second attack and again improvement	1 mo. 2 wks.	5 mos.	57
35	Trauma: left central and parietal lobes	Slight	Sudden, marked deterioration after operation with subsequent improvement	Receptive	Slight	Sudden deterioration after operation with subsequent improvement	3 mos.	1 mo.	28

TABLE XVII (*cont.*)

CASE NO.	NEUROLOGICAL DIAGNOSIS	DEGREE OF INVOLVEMENT	COURSE OF DISEASE	TYPE OF APHASIA	DEGREE OF APHASIA	COURSE OF APHASIA	INTERVAL BETWEEN ONSET OF SPEECH SYMPTOMS AND FIRST EXAMINATION	EXAMINATION CONTINUED OR REPEATED OVER	AGE AT BEGINNING OF STUDY
GROUP III (*cont.*)									
44	Tumor: meningioma of left parieto-occipital area with right homonymous hemianopsia	Moderate	Sudden deterioration after operation with subsequent improvement	Receptive	Slight	Sudden deterioration after operation with subsequent improvement	(Unnoticed before examination)	3 mos.	34
60	Tumor: adenocarcinoma of the left temporal lobe	Moderate	Sudden deterioration after operation	Receptive	Moderate	Sudden deterioration after operation with slight and temporary improvement	3 mos.	1 mo. 2 wks.	51
27	Trauma: softening in left parieto-temporal area	Slight	Approximately stable	Express.-Recept.	Severe	Probably deterioration after first operation, but slight gradual improvement during period of study	8 mos.	8 mos.	31
17	Tumor: spongioblastoma of the left temporal lobe with right homonymous hemianopsia	Severe	Further deterioration after operation with subsequent slight improvement	Amnesic	Severe	Sudden deterioration after operation with subsequent slight improvement	5 wks.	1 mo.	36

sive-receptive patients who were extremely limited in all language functions. Only one, No. 12, made any regular and satisfactory use of speech as a means of communication; she was able to print a few words. Another, No. 15, as reported in Chapter X, was noteworthy among the expressive-receptive patients because of his relatively high non-language performances. On the whole, however, the patients were all seriously limited, and even the one expressive patient of the group, No. 20, had great difficulty in speaking and writing and at the same time showed an extensive disorder affecting all other language processes and non-language performances as well.

With such severe disturbances which separate the patient from others and interrupt all mental functioning dependent upon language symbols and much that is relatively independent of language, it might be expected that repeated studies would show gradual deterioration. Such was not the case. Deterioration was observed in some of the tumor cases and in cases where there was depletion or a second attack, but not in this group of vascular cases where the patients' physiological and neurological condition remained about the same throughout periods of study ranging up to three years. It is evident that these low levels of language and of mental functioning in general need not bring about further deterioration within periods of two or three years, or, if the earlier records may be taken as satisfactory, within six or seven years.

While these patients did not deteriorate further, they did not show any noteworthy improvement. The lack of progress is particularly significant in the case of No. 15, whose non-language performances indicated a relatively high level of mental functioning. With 36 per cent of his non-language performances exceeding the medians of the normal group, this patient was obviously capable of some forms of intelligent behavior; yet he had not in the five years since his attack learned to use new words or to make more satisfactory responses to them. Apparently then, extensive language deterioration may remain unchanged for a number of years in cases where the severe disturbances are confined largely to the language processes as well as in cases of more extensive deterioration.

On the whole the stability shown by these patients is remarkable.[1] They have obviously fallen to levels below their normal levels, and differing individually with regard to the extent and the degree of the disorder, but persisting with little variation throughout years. (In addition to cases Nos. 15 and 37 in preceding chapters, see cases Nos. 3, 20, and 26 in Appendix I.)

---

[1] In most cases repeated examinations showed variations in one or two performances, but there were never differences which would constitute a change in the disorder as a whole. Generally the differences were within the limits which might be expected from the reappli-

It is an open question whether patients with such severe language disturbances, who have relearned practically nothing from their everyday experience, could ever be reeducated to any extent by formal training. Because of lack of time no reeducation was attempted in such cases.

3. IMPROVEMENT

Of the 18 cases of the group showing improvement, 15 made appreciable progress during the course of the examination; 3 had, as indicated by the records, improved greatly before the examination period but they did not change during that period. In the whole group of 36 patients in question, these 18 were not the only ones who improved. The 11 patients of the third group are classified on the basis of the deterioration which took place at some time in the course of the disorder, but many of them later made some improvement. The 18 of the second group, however, are differentiated on the basis of their relatively steady and uninterrupted improvement.

A comparison of the neurological and psychological findings shows that in 15 of the 18 cases improvement psychologically is accompanied by amelioration of the neurological symptoms. Furthermore, in 14 cases the rate of improvement corresponds, that is, improvement is gradual in both neurological and psychological conditions, or rapid in both. The extent of the progress, however, does not correspond so closely, for only 7 cases made slight improvement in both neurological and psychological conditions or marked improvement in both. The findings as they appear for the

---

cation of the tests. It is impossible to state the reliability of any test as applied to aphasic patients. A second test is rather an index of change in the patient's condition than of the reliability of the test. Some indication of the reliability might be gained from the correlation of alternate items of the test if sufficient homogeneous material were at hand. In any particular performance, however, there are such great differences between patients and so many different factors that the significance of such correlations would be doubtful. The most satisfactory procedure seems to be to select tests known to be fairly reliable for normal persons and to bear in mind in the interpretation of the test results for aphasic patients that slight differences on successive applications may well depend upon factors within the test or the test situation.

individual patients of the group in Table XVII above are summarized in Table XVIII.

It has already been stated that the proportion of expressive patients in the group showing improvement is a little higher than in the whole group of 36 (78 per cent as against 50 per cent). These cases are apparently the most likely to make progress. It has also been noted that the expressive-receptive patients, who constitute the large majority of the stable group, are not to be found in the group showing improvement. One expressive-receptive patient, a traumatic case, did improve in speaking; he falls in the third group, however, because of the deterioration which followed his first operation. With regard to possible differences in the extent and rate of improvement in different types of disorder there can be no conclusions, for the many subgroups required for such an analysis are too small.

TABLE XVIII

RELATION BETWEEN PSYCHOLOGICAL IMPROVEMENT AND REGRESSION OF NEUROLOGICAL SYMPTOMS IN EIGHTEEN CASES

PSYCHOLOGICAL COURSE	NEUROLOGICAL COURSE					
	GRADUAL REGRESSION		RAPID REGRESSION		NO REGRESSION	TOTAL
	Slight	*Marked*	*Slight*	*Marked*		
Gradual improvement						
Slight	3	2			1	6
Marked	5	1				6
Rapid improvement						
Slight			1		1	2
Marked	1			2	1	4
Total	*9*	*3*	*1*	*2*	*3*	*18*

Much of the data concerning improvement has already been presented in the individual case reports in preceding chapters; Nos. 4, 16, 33, and 50 in Chapter VIII, and No. 31 in Chapter IX are the cases of most importance here. Another case, No. 24, will be reported in Chapter XVI as an example of the effect of training in an expressive disorder. Four additional cases are to be found in Appendix I: Nos. 10, 21, 43, and 51. In many of these cases, the disturbances were so severe and the patients' performances consequently so far below the normal ranges that they could not be expressed in terms of deviation from the medians for the normal group. Disturbances in speaking and in naming, being relatively infrequent in normal individuals, could never be expressed in terms of normal variability but had always to be described for themselves. As a result, improvement in the severe cases or in the cases where speaking was most affected can be best understood from the case records, and the reader is referred to these. In some of the less severe disorders, however, the performances and the improvement on repeated examinations can be represented fairly by graphs such as those given in individual case reports.

Of these the most interesting is that representing the progress made by No. 4 (Figure 1, page 162). In spite of the fact that not all tests were given at each examination, and consequently that the lines indicating the results of successive examinations are not complete, this is a most satisfactory record. Improvement, except in non-language tests, was general and regular: the performances recorded at the second examination were almost all higher than those at the first, and the third higher than the second, so that the lines representing the successive performance levels rarely cross each other. The interval between the first and the second examinations was two months, between the second and the third four months. It is therefore apparent that, while the progress was regular, it did not continue at the same rate; there were smaller increments of improvement as time went on. It is also apparent that while improvement took place in most performances, it was more marked in some than in others. On the whole, the greatest improvement occurred in performances at first most seriously disturbed, such as speed in giving the "opposite" of stimulus words, or performances on the Sentence Completion Test. In Figure 1 this condition is indicated by the greater irregularity of the line representing the first examination than of the lines representing the second and third. Thus the most marked changes psychologically tended to disappear as the disorder became slighter.

The graph for case No. 16, who is also reported in Chapter VIII, shows the much more rapid progress which characterized this case (Figure 7, page 197). So many of this patient's performances were below normal ranges on the first examination that the graph does not reveal the relative amount of the change in different activities. Survey of the case record, however, will show that here again, the most marked improvement occurred in the performances at first most seriously disturbed.

In cases Nos. 24, 10, and 21 the most severe initial disturbances and the greatest changes occurred in speaking, where the patient's performances could not be expressed in terms of normal variability. Consequently graphs in these cases are not particularly useful in indicating the extent of improvement. Figure 21 (page 394) shows that with No. 24 a wide variety of performances improved during the first year. Thereafter progress in speech responses continued, but progress in other performances was less extensive and regular because the patient was apparently nearing her original levels. In the other two cases, No. 10 and No. 21, the patient's initial endowment was probably less; both showed severe aphasia and made relatively little progress except in articulation and word-formation. Many of their performances were below normal ranges on the first examinations and still below on the second. In every instance, however, some improvement had occurred between the first and second examinations.

The general tendencies with regard to the nature and extent of the improvement which are indicated by these graphs are also to be found in the other case records. In summary of the evidence from the whole group of 18 cases, it may be stated:

1. That when the improvement is not interrupted by physiological changes or conditions causing the patient to worry or become depressed, it is usually steady and regular; even slight and temporary periods of deterioration are rare. At the same time there seem to be no sudden spurts when the patients' scores are increased greatly over the levels immediately preceding. These general statements of course apply to the disorder as a whole. As the graphs show, individual performances were sometimes irregular. At the same time the variability was never great, and it was the regularity of the improvement which was most apparent.[2]
2. That the improvement is usually general, affecting almost all of the performances tested.
3. That the improvement is likely to proceed at a decreasing rate, with smaller increments of progress as time goes on. In other words, the regularity

---

[2] For a discussion of variability, see Chapter XII. Several of the graphs (Figures 1, page 162, and 10, page 239) seem to indicate greater irregularity in non-language than in language tests. The difference probably depends largely on the fact that many of the non-language tests as recorded are separate parts of a larger non-language "scale"; they are really "items" in the total scale and consequently more likely to vary than the total would be.

implies only that there is constant progress, not that the rate of improvement is constant.

4. That the performances at first most seriously disturbed are likely to show the greatest amount of improvement, so that the disorder as a whole tends to lose its distinguishing characteristics with time.

The processes at first more severely affected are naturally those which have the greater potentiality for improvement in the return toward a more normal condition. As they improve the disorder changes in that it becomes more general and more difficult to classify as of any particular type of aphasia. Within this group of aphasic patients, however, there were no changes which would indicate a shifting from one type of aphasia to another. Furthermore, while the most severe disturbances usually decreased with time so that they no longer stood out as the most prominent part of the disorder, there were no changes by which one disturbance became less marked and another more so. Only one qualification to this statement is necessary: in some cases one disturbance was so severe that it masked another and the second became evident only as the first disappeared. Thus No. 43, for example, at first had had all the usual difficulties in articulation of the severe expressive disorder. When her speech grew more clear, however, it was apparent that she was misusing names; in other words, that there was another disturbance present which made the disorder as a whole more complex than it had at first appeared to be.

4. DETERIORATION

The third group, as already stated, includes 2 cases where gradual deterioration could be observed and 9 cases of sudden deterioration as a result of a second attack or of operative or other treatment. Two of the cases are vascular, 7 tumor, and 2 traumatic. The group is thus heterogeneous and does not lend itself to general discussion.

In one vascular case, No. 6, where the aphasia was of the expressive type, the depletion caused by pneumonia led to more severe neurological involvement and to marked increase in the aphasia, which had largely disappeared after the first attack. The gradual improvement after the pneumonia cleared up has been reported in Chapter VIII. The other vascular case, No. 22, showed a receptive type of aphasia, with particular difficulty in reading, which has been described in Chapter IX. The course of the disorder here has been fairly well illustrated by the graph presented with his case report in Chapter IX (Figure 10, page 239). Between the first and second examinations, there had been a slight but pretty general improvement. During the seventh month after the onset, however, because of increased vascular tension the patient had an attack of unconsciousness and, although there were no further neurological symptoms, the aphasia was definitely increased. Tests made within the next week showed lower performance levels, which are represented on the graph by the hollow rings. The nature of the deterioration is important: the disturbances which were already present became more severe, approaching, as it were, their earlier condition, but there was no change in the type of the disorder. During his last four weeks in the hospital, repeated tests of naming and reading showed that the patient's condition again improved slightly.

Among the tumor cases there were only two in which gradual deterioration could be observed, for the disorder was usually far advanced before the case was reported for examination. In both of these cases the aphasia happened to be amnesic. One of these patients, No. 18, whose report is given in Appendix I (page 558), was studied during a period when a large gliomatous cyst in the left fronto-temporo-parietal lobes was repeatedly tapped. The aphasia and the weakness of the right side became more marked as the cyst cavity filled and again receded after it was tapped.

In the other case of gradual deterioration, No. 7, reported in Chapter XI, the scores at a second examination fourteen months after the first were almost all lower (Table XIII, page 306). The patient had been under observation during the interval and had been found to show gradually increasing symptoms both neurologically and psychologically. Operation performed just after the second examination revealed a large infiltrating glioma of the left temporo-parietal area; part of which was removed. Psychological studies after operation showed that the aphasia had become much more marked, so severe in fact that the patient could not even attempt many of the tests on which he had earlier had some success. As indicated by the scores in the third column of Table XIII, the tests which he could attempt in the first two months after operation were less well done than before.

The conclusions which can be drawn from these two cases are of course limited. Studies of other cases or other types of disorder might yield different findings. Nevertheless, it is worth noting that in each case the nature of the disorder remained the same as the various disturbances became more severe.

On the whole, the course of the neurological and psychological conditions in the 9 tumor and traumatic cases of this group was closely parallel. It was often evident, however, that in the pre-operative period the neurological and the psychological disturbances had developed at different times, and that in the post-operative period the one improved more rapidly than the other. These questions have been discussed in Chapter XII, page 317. With regard to the course of the disorder, it is necessary to add here only that the findings for the tumor cases support the evidence already presented as to the regularity of the psychological changes, whether they consist of improvement or deterioration. Survey of the case records and graphs reveals that the pathological disturbance has resulted in more or less extensive changes in mental functioning with differences in the levels of various performances. The alteration in any case, however, exhibits considerable regularity, and progresses or regresses in an orderly way. There may naturally be changes when a new pathological condition has been introduced by operation, but otherwise the regularity in the psychological processes is the striking condition.

5. SUMMARY

The 36 patients of the aphasia group who were studied over long periods of time, or during shorter periods when the aphasia was changing rapidly, furnish the data on the course of the disorder. These patients may be divided into three groups: those who were stable, those who improved, and those who deteriorated.

The stable group comprises 7 patients who showed little or no change neurologically or psychologically during a median study period of 18 months. The large majority of these, 6 of the 7, were expressive-receptive patients. It seems clear that patients with this type of aphasic disorder are particularly likely to remain stable, and as further evidence of this situation there is the fact that this group of six patients includes all but one of the expressive-receptive patients observed over a sufficiently long period of time to determine the course of the disorder.

The group showing improvement includes 18 patients, whose improvement psychologically was usually accompanied by amelioration of the neurological symptoms. The rate of improvement usually corresponded, with gradual progress both neurologically and psychologically or rapid progress in both conditions. There was not such a close correspondence, however, between the extent of the improvement in the two conditions. In this group there is a higher percentage of expressive patients than in the whole group, a finding which supports the opinion that expressive patients are the most likely to progress. The general characteristics of improvement, as revealed by survey of the case records and graphs, may be summarized by the following statement: the improvement tends to be regular and to appear in all performances, but it is likely to proceed at a decreasing rate as time goes on and to be greater in those performances at first most severely affected.

The group showing deterioration is a heterogeneous one, containing 2 vascular, 7 tumor, and 2 traumatic cases. In one vascular case the deterioration came with the depletion caused by pneumonia; in the other it followed an attack of unconsciousness which did not lead to any change in the neurological picture. In each case the aphasic disorders were the same as before but more severe. In the two tumor cases where gradual deterioration could be observed, the disorders also became increasingly severe but not different in nature.

On the whole it is the regularity of the psychological changes which is most striking. Variations appear in individual performances in most cases, but, unless new pathological factors are introduced, orderly progression or regression is the rule.

XVI

REEDUCATION IN APHASIA

1. Training methods
2. Case No. 24
3. Results of training
4. Summary

1. TRAINING METHODS

THE most important principle in the reeducation of aphasic patients is that the work in each instance must be especially adapted to the individual patient. It is no more possible to outline a method of training in general than it is to prescribe one kind of treatment for all the patients coming into a medical clinic. Each case is a problem which requires careful and continuous study, and training especially adapted to overcome specific defects and make the most of abilities which are still within the patient's power.

The second important principle is that the practice work shall be as closely as possible related to the performances which the patient has to regain. There have often been attempts to train some hypothetical "faculty," such as memory, for instance, with the expectation that the learning of one type of material would aid in the learning of another. Thus patients were sometimes asked to learn series of nonsense syllables. Artificial exercises of this sort were not used in this research. There is not sufficient evidence of their value either from normal or abnormal studies. Furthermore they are puzzling to the patient, and they never arouse his interest and cooperation as do exercises which are, as he himself can see, directly related to his particular difficulties.

In patients of the expressive type some of the training must almost always be adapted to overcome defects in the production of speech sounds. A patient who articulated badly, like No. 24, who is reported in the next section, was shown the correct position for the various speech sounds, and given practice in producing these singly, in simple words and in words or sentences which contained related sounds and consequently required exact sound differentiation.[1] When, for example, a "v" was pronounced like an "f," both positions were shown; the patient then repeated and suggested simple words such as "vine" and "fat" and then sentences containing both sounds, as "They fell off the vine." In general the repetition of words and sentences containing the sounds to be practiced was emphasized rather than drill in isolated sound formation; the former was less fatiguing to the patient and more directly in line with the end to be accomplished. In some cases, however, where there was marked lack of control of the speech muscles, the correct production of single sounds was drilled and in addition a number of lip, tongue, and soft palate exercises were introduced.[2] In most of the expressive cases oral reading was more satisfactory from the point of view of articulation than speech, and consequently practice was given in oral reading with the idea that the relative fluency here might be useful for speech. In such a case the two performances seemed to be sufficiently alike for training in one to have value for the other.

In some predominantly expressive cases training in the articulation of speech sounds is less necessary than work on the formation of letters in writing. Difficulties with letter forms may be attacked by having the patient copy the letter as he says it aloud, or trace it with his finger before writing it. The one method may be of more value than the other according to the patient's defect and original performance. In any case, if language is not too seriously disturbed, it is advisable to take up the particular difficulties, for instance, with "m" and "n" or "b" and "d," and describe the characteristics of these letters in addition to giving special drill on them.

The expressive patient requires not only training in articulation or letter formation, but work on word-forms, vocabulary, and sentence structure. In some cases of difficulty in word-formation he must be taught more about the word than the non-aphasic patient would have to know before being able to use it in speaking. The aphasic's grasp of the word as a whole is likely to be so uncertain that he must learn to break it up into its component letters, if it is spelled phonetically, or into syllables. With polysyllabic words an overemphasis on rhythm is often of assistance. The greatest aid, however, is usually to be obtained by writing the word. Sometimes it is sufficient for the patient to practice writing the words and saying them aloud at the same time. Sometimes he must divide the word into syllables, saying each syllable separately and putting hyphens between them in writing. In other cases where the confusion is more severe, he must sound the letters as he writes words spelled phonetically. Gradually with practice he learns to make his sounding of the letters like a slow pronunciation of the word.

---

[1] In general the discussion will deal with the work necessary for the less severe disorders or stages of the disorder. This is most important for it is the problem most often met. The methods required for the more severe cases can be judged from those described. For example, in regard to the production of speech sounds, the patient who at first can neither repeat nor read aloud must be taught by demonstrations of the correct positions for the speech sounds, in which a mirror is sometimes helpful, and by building on any fragments of propositional or automatic or emotional speech which he has left.

[2] The specific training on the various speech sounds and the lip, tongue, and palate exercises will not be reviewed in detail. They can be found in any good text on speech training or speech pathology. See, for example, S. M. Stinchfield, *The Psychology of Speech* (Boston: Expression Company, 1928), especially Chapter VI; L. E. Travis, *Speech Pathology* (New York: Appleton, 1931), especially Chapter VI.

With regard to the learning of words it must be noted that one of the major contentions of the early writers was that the training should involve as many sensory approaches as possible. The patient should see the letter he was learning, hear it pronounced for him, repeat it, and write it. Similarly he should be shown the object or a picture of the object as he pronounced and wrote its name. It is undoubtedly true that the various perceptions and responses should be coordinated, and the training for these patients was arranged to follow the old methods in this respect. It is also true, however, as Goldstein and other authors have pointed out, that there may be some one approach by which the patient can learn more easily. For example, he may make most progress by visual aids, that is, when he can see the object or the word or the number combination. Examinations were always given to see whether such a characteristic existed and, if it did, advantage was taken of it.

The training in the production of speech sounds is not necessary in predominantly receptive or in amnesic cases. The drills in word-formation with emphasis on the spelling of the word and the division into syllables are rarely necessary for the amnesic cases, but are of distinct value for the predominantly receptive, particularly when the patient uses garbled words in speaking and writing. Training which will increase the vocabulary in the sense of the stock of words available for use in expression is important in all three types of disorder. Drills for word-formation and vocabulary were always composed at first of the most frequently used words in the language so that whatever gain the patient made would be of greatest and most immediate service to him. The first five hundred or one thousand most common words as listed in Thorndike's *Teacher's Word Book* were reviewed by having the patient pronounce them, use them as names for objects, define them, or construct sentences of them.[3] If he already knew these or had learned them, the next thousand words were taken up. This type of work was used extensively in the training periods. To supplement these words and make certain that he was learning what he actually needed most to know, and also to increase his own interest and sense of responsibility, the patient was asked to write down in a notebook any word he had had difficulty in pronouncing or evoking. If it were the name of a familiar object like "scissors," he sometimes wrote it many times while looking at the object and if possible manipulating it. If it were a more abstract term like "miracle" and the patient were sufficiently intelligent, he was directed to write the word, look it up in a dictionary, write its meaning or that part of the definition he could understand, and then write several sentences in which he used the word.[4]

With all patients efforts were made to increase the interest and value of the practice by connecting it with daily experience. The housewives, for example, were asked to try to make out their own market lists, and write down the groceries, meats, and vegetables they would need. This was attempted even when speech was very limited. The woman first went over the stock she already had in her kitchen, writing down the names of provisions and trying to list them in the correct groups. She was then given a magazine rich in advertisements and directed to turn through its pages and note down what she would want to buy. The patients who were able to read were referred instead to the newspaper advertisements of the chain stores because they could make more complete orders from these. Whenever the examiner had time enough, practice in arithmetic was also introduced in connection with the marketing lists.

---

[3] E. L. Thorndike, *The Teacher's Word Book* (2d ed.; New York: Teachers College, Columbia University, 1927), 127–129.

The new vocabulary of *basic English* (C. K. Ogden, *The System of Basic English,* Harcourt, Brace, 1934) may prove of value in the teaching of aphasics. It would be difficult, however, to teach the new methods of using words and the new constructions which are required if the 850 words of the vocabulary are to be sufficient. It would probably be easier to teach a larger number of words to be used in the forms of speech which are still more or less well organized.

[4] When patients showed no disturbances in behavior but were greatly annoyed by difficulty in remembering the simplest words, they were sometimes asked not only to make lists of these words and use them in sentences in the ordinary way, but to make a conscious effort to formulate their plans verbally and to speak as they carried through daily routines. For instance when coming to town, such a patient would say: "I am going to town. I am going on the train. I have to go to the station and get a ticket," etc. If he had difficulty with these familiar words either as he made his plans or carried through the actions, he would refer to his notebook for them. This type of practice seemed to be within the ability of the more intelligent patients on whom it was tried, but the examiner had no means of checking how thoroughly they used it. It was advocated in only two cases, however, and then with some caution, for it seemed possible that the forceful introduction of speech, and especially disturbed speech, into reactions which were at least partly automatic and independent of language might have an adverse effect on those reactions.

The matter of sentence structure like that of vocabulary and the correct use of words was important in all cases. For the most part the same training seemed to work for the abbreviated incomplete sentence forms of the expressive patient and the confused forms of the predominantly receptive. Each was asked to construct sentences, both orally and in writing, using given single words, and then two or three or more words. For the predominantly receptive patients, however, there usually had to be explanations as to grammatical forms and constructions, which were not necessary for the predominantly expressive.

With the greater realization of the complexity and extent of the aphasic disorder, it has become evident that the faulty expression depends not only on specific defects of articulation, formation and use of words, sentence construction, and so forth, but on changes in language and thought processes which cannot be isolated for separate study or training. They must be approached directly, namely, through practice in speaking and writing. The conditions require the use of more complicated training methods than were formerly employed. One which was devised for the patients of this group, the abstracting of a story or newspaper account, satisfies the requirements particularly well. It may be looked on as a half-way stage between the propositional speaking which is so difficult for the patient, and oral reading, which is easier, and satisfactory as practice for articulation but not for the more complex processes of expression. A number of variations of the method may be introduced. Usually the patient reads a short story or article, or in the beginning only a paragraph, and reports it aloud. At first he sometimes gives only a vague or irrelevant statement about it or a few details; he may do better on a second reading and he is usually able to do a great deal better after discussing the material with the examiner. Gradually his own report improves after one reading, and contains either a larger number of details or a more satisfactory statement of the essential point. When the patient has great difficulty in reading but understands spoken language fairly well, the method may be changed so that he reports a story or article read to him. When the disorder is too severe for either of these methods to be feasible, the most satisfactory substitute is then the description of a picture or picture sequence. Naturally any of these reports may be given in writing rather than orally, and this change is often useful when sentence structure is affected.

Up to this point the discussion has centered on training for the specific and the complex changes in expression in both expressive and receptive cases. The work on the correct perception of speech sounds or letter forms and on the understanding of spoken language and printed material is more difficult, and has generally been found less profitable.[5] No drills for the correct perception and understanding of single words were used in this research for none of the patients trained had particular difficulty in these processes.[6]

There were, however, several patients of both expressive and receptive types who understood single words or simple sentences, but not longer or complex statements, and who were given special practice intended to overcome some of this difficulty. As in training for the disturbances in expression, work was arranged to duplicate the actual performances causing the difficulty or to represent a simpler form of these. Sentences were read to the patient which were just too long for him to repeat verbatim, and he was asked to give the essential point either orally or in writing. When he did not succeed they were reread until he did, or else they were finally discussed with him. When he could understand single sentences, paragraphs were read to him. The same sort of practice was introduced for difficulties in understanding printed material, that is, the patient read a sentence or paragraph, looked away from the page, and told the examiner what it meant. When he practiced by himself, he wrote down his abstracts and brought them to the examiner for discussion. Often this work in repeating the content or essential point revealed particular difficulties in understanding certain turns of speech or grammatical constructions, and these could then be translated, as it were, or explained to the patient. The value of the work from the point of view of defects in expression has already been discussed. Training in both expression and in understanding naturally came from the same exercises, but the patients usually chose the passages they wanted to abstract for practice in speaking or writing, while the examiner chose those for practice in grasping the content or essential point of the material, and attempted to grade them so that the patient was continually trying to understand more difficult passages.

---

[5] See for example the case of "word-blindness" reported by Mills and Weisenburg in 1905, where intensive training resulted in comparatively little improvement.

[6] The reader is referred to Goldstein's discussion of this type of training, *Die Behandlung, Fürsorge und Begutachtung der Hirnverletzten*, 1919, 108–109; but this author gives no examples of training in cases of complete word-deafness for he did not find such cases among the head injuries during the War.

In the many cases where there is a loss of motor function on the side of the preferred hand, the patient must learn to use the other hand as a substitute. It usually takes him only a few months to learn to write easily and legibly, if not quickly.[7] In so doing he is undoubtedly organizing nerve processes which did not function before in connection with writing, and these are for the most part to be related to the uninjured hemisphere. Whether this transfer of activity to uninjured areas has any part in developing new or more satisfactory language responses is open to question. There is not enough knowledge of cerebral organization or enough evidence from controlled studies to prove the matter one way or the other. The possibility, however, remains that development in the right hemisphere may lead to improvement in the language performances which have been disturbed by the changes in functioning in the left, and furthermore that learning to write with the left hand may aid in that development in the right hemisphere. In view of these possible advantages from the use of the left hand, two patients who did not have to use the left because of paralysis of the right were nevertheless trained to do so.

Finally, it must be noted that a very important and sometimes the most important function of the reeducation is to contribute to the patient's sense of well-being and to increase his morale. The training must be adapted to arouse his interest and to make him feel reasonably encouraged. It is necessary not only to use material which is inherently interesting to him, but to arrange the work so that he is always bringing some performance within his power, and then turning to attempt the next more difficult step. When he sees progress his cooperation is insured and his attitude is almost always extremely satisfactory for further learning. He not only responds well to specific teaching, but he is on the look-out for all sorts of experiences in his daily life which he can turn to some profit from the point of view of reeducation. He pays a great deal of attention to the newspaper, for instance, and instead of reading simply to fill in time, he begins to practice to see how well he can read a passage and then repeat it to himself. In the examinations of aphasic patients, a satisfactory relation between the patient and the examiner is very important. It is even more important when reeducation is undertaken, for then the patient who has confidence in the examiner progresses better in the specific training and in addition derives considerable benefit from the free discussion of his problems and from the encouragement which he steadily receives.

---

[7] Thorndike has found that normal adults can learn to write with the non-preferred hand fairly quickly. *Adult Learning* (New York: Macmillan, 1928), 33–43:

> Within the short period of fifteen hours of practice, plus forty minutes' allowance for the practice effect of the tests themselves, those subjects who maintained substantially the same quality of handwriting, much more than doubled their speed. Those subjects who worked for a higher quality obtained it and still made very substantial gains in speed. . . . In general the gain . . . from less than sixteen hours of practice was greater than the gain proposed by experts as suitable to be accomplished by children using the right hand in two years of growth and schooling, including one hundred or more hours of special practice in handwriting.

2. CASE NO. 24

The most satisfactory case for the purpose of a controlled study of the effect of reeducation was No. 24. This patient was examined two weeks after the onset. She then remained without training or any other psychological examination for seven months, when a thorough study was made and training was begun. Unfortunately full advantage could not be taken of the perfect experimental situation offered here, because not enough time could be spared for adequate reeducation. The patient was given one or two hours a week, however, and practiced by herself, and this amount of training has been continued for about seventeen months. Her record is of interest not only as a controlled study where the effects of reeducation could be estimated, but as an example of training methods in a type of case which is frequently met and fairly responsive to treatment, namely, where the most pronounced disturbances are in articulation and word-formation.

No. 24. *A case of predominantly expressive disorder with marked difficulty in articulation and word-formation and a tendency to leave out the less important words in speaking and in writing. The lesion was probably an embolism of the left middle cerebral artery.*

Female, white, 45; glazer; completed the equivalent of 6 grades; right handed.

Psychological Summary

The aphasia was predominantly expressive, and on the first examination the disorder was severe. The patient attempted to speak at some length, but articulation and word-formation were so defective that very few words were comprehensible. Her writing was at this time superior as a means of expression, but disturbed by spelling errors, abbreviated structure, and some serious confusions. Later when speech became more intelligible the tendency to leave out the less important words was noticeable in speaking as well as in writing. A characteristic in which No. 24 differed from the majority of predominantly expressive patients was the rapidity of her speech or attempts at speech. It was also noteworthy that her speech and writing were extensive; there was no such scarcity as there is in many predominantly expressive cases.

The patient's understanding was always relatively good. Indeed, after the early period her grasp of spoken language was no more limited than might easily be normal for a person of her educational and intellectual level. Her understanding of printed material was slightly more limited and slower to improve—a condition which was also natural for her educational level.

After the first period she did well in language intelligence tests which demanded the rapid production of words under given controlling conditions, but less well on the other types of test. Her non-language performances were also good from the point of view of speed of reaction, but less satisfactory from the point of view of the level of difficulty she could attain. They fell with unusual regularity around the lower quartiles for the normal group.

Figure 21 (page 394), where the patient's performances are represented in terms of the variability of the normal group, shows her relative levels in various performances and the improvement on successive tests. The black dots represent positions at the first examination two weeks after the onset. The crosses and broken line represent positions on the second examination seven months later, a more complete examination. It will be obvious that there had been considerable improvement in this interval before any training was begun, particularly in writing to dictation and in the speed of her responses on the Opposites Test. Progress in these performances reflected a greater facility in speaking and a greater accuracy in understanding spoken language over the first examination. Tests and obser-

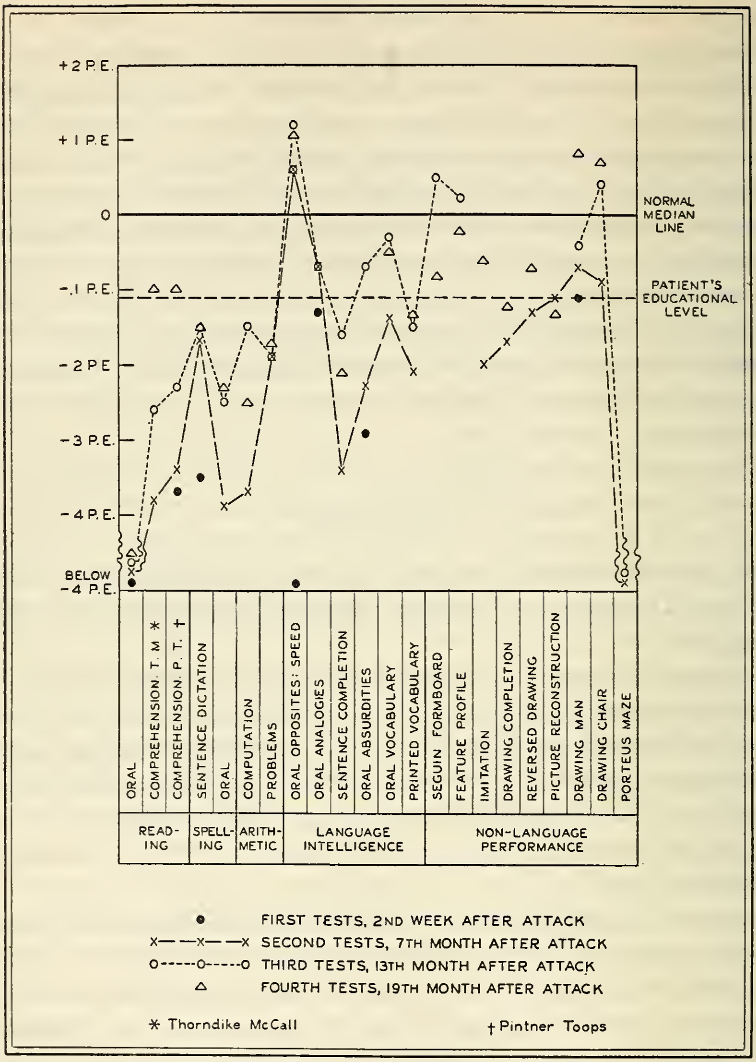


Figure 21. Successive performance levels: Case No. 24, expressive

vations indicated that understanding, which was not seriously disturbed even at first, had become nearly normal by the time of the second examination. Progress in speaking, however, had not been sufficient to make the spontaneous expression much more comprehensible than before, and difficulties in articulation and word-formation were still the most pronounced characteristics of the case.

The training was begun simultaneously with the second examination, and concentrated on articulation and expression in speaking. The patient also did a great deal of writing and learned to write with the left hand, but, because of lack of time, no attempt was made to correct her spelling or to improve the structure of her written expression. The hollow rings connected by a dot-and-dash line in Figure 21 represent the performances on the third examination after six months of training. There was great improvement in oral reading, although the scores were still below normal ranges, and great improvement in reading comprehension, oral spelling, arithmetic computation, sentence completion, oral absurdities, and oral vocabulary. Speech was much more clear and when the patient attempted to speak fairly slowly, as she had been taught to do, she was almost always able to make herself understood. The bulk of the evidence showed that there had been far more improvement during these six months of training than during the first seven months after the attack.

The training was continued and the examination repeated after another six months with results close to those of the third examination. Judged from the test results alone it would appear that the patient had almost reached the limit of her progress, and to a certain extent this was probably true. She was below the median for the normal group in education, and she had certainly never been far above the median for that group in intelligence. Figure 21 shows that many of her performances on the third and fourth examinations cluster around her educational level. They would not be expected to go much higher. Nevertheless all the results of the fourth tests were adversely influenced by the fact that the patient was unhappy and very much worried at this time, for her husband's ill-treatment had, as it were, reached a climax. Training is still being continued and if her personal difficulties can be adjusted, the next tests will in the examiner's opinion show improvement in performances specifically related to spoken expression. It is not likely that there will be further improvement on either language or non-language intelligence tests.

No. 24 cooperated exceedingly well at all times. She was willing to attempt any type of work and able to work hard and steadily. She had a fair insight into her disorder; while she probably did not realize its severity, she was able to put her finger on many of her specific difficulties and so to make a more purposeful effort to correct them. Her work was disturbed, particularly during the last eight months, by her anxiety over financial matters, fights and raids in the apartment-house for which her husband was janitor and where they lived, and by her husband's infidelities and ill-treatment. In view of the constant turmoil in which she was living it is surprising that she maintained the gains in speech and other performances which she had made during the early months of training. She continued to do her practice work, and during times of stress wrote even more than usual because the writing helped to get her worries "off her mind."

Neurological Summary

Prior to her admission to the University Hospital for a gynecological operation, the patient had suffered from hypertension for years. While in the hospital, she was operated upon and was under ether a long time and had difficulty in coming out of it. When she did so, she had a complete right hemiplegia and was unable to talk. The reflexes on the involved side were increased, with ankle clonus and Babinski. At first it was thought that she had some disturbance of sensibility on this side but when examined later this was not found.

Further examination showed that she had a paralysis of the left external rectus, which had been present a long time, with a distinct Argyll-Robertson pupil. The discs showed a marked arteriosclerosis. The hypertension was quite marked, the average pressure being 210/120. Repeated serological examinations were entirely negative.

The hemiplegia and the aphasic symptoms gradually diminished.

The diagnosis was probably an embolism of the left middle cerebral artery, the lesion being largely in the motor area.

First Psychological Report

SPEAKING. At the first examination two weeks after the attack, No. 24's *spontaneous speech* was plentiful, but the words were so badly formed and articulated that they were practically unintelligible.[8] While the flow of speech sounds was rapid, its production required considerable effort, and the patient would often stop to attempt more satisfactory articulation. Usually her responses contained an occasional word or phrase which was recognizable, notably "shure," "mother," and "applesauce." The rhythm of her speech was badly disturbed and explosive, accented phrases were followed by periods of monotony.

---

[8] The errors were so severe at this time that an analysis could hardly be made. See under Speaking in Second Psychological Report, page 399.

Tested on *automatic word series* she counted with articulation slightly better than that of spontaneous speech. She had no difficulty with the series as such and could count by two's and five's as well as by one's. She said the names of the days of the week intelligibly in 12 seconds, but could pronounce very few of the names of the months. She gave some of the letters of the alphabet in correct order, but had to omit others because she was unable to articulate them.

Occasionally short phrases in *reactive speech* were fairly clear, for example, "Good-bye," "Oh, all right," "I can't."

Naming. Even at this examination, No. 24 could name objects, colors, and the line drawings of the Kuhlmann Test correctly. The words were badly misformed but, perhaps because the examiner knew what they were intended to be, they were more easily recognized than the words of spontaneous speaking.

Repeating. The patient's articulation was distinctly better in repeating than in spontaneous speech, but there were still many errors. In nature these were like the errors of spontaneous speech.

Understanding spoken language. No. 24 understood simple questions and directions without error. Her understanding was fairly satisfactory in ordinary conversation. At the same time she often failed to grasp more complex questions and her execution of twofold or threefold commands was poor. The limits of her understanding of complex statements were clear from the results of the Absurdities Test.

Reading. No. 24 was handicapped in oral reading by her difficulty in articulation. At the time of the first examination, she could pronounce only eight or ten words of the Gates Graded Word Pronunciation Test, and thus failed many of the simplest two-letter and three-letter words. Hardly any words were recognizable in her attempts to read connected material, however easy it was.

Her *comprehension of reading* was far superior to her pronunciation, but nevertheless to be classed among the poorest of the performances of literate normal subjects.

Writing. At this examination the patient's writing was on the whole superior as a means of expression to her speaking. While words and even letters were misformed in writing, the product was much more comprehensible than the speech. A typical record of *spontaneous writing* is the following:

Phila Pa
April 12
Dear Mother
Over to see me soon
I am up to chiar Nelson will be
me
me aromd ~~ence~~ see I will home
perhap if nothing well

Although confusion was less marked on later examinations and specific errors less frequent, the nature of these errors remained the same. The patient not only formed letters poorly, particularly at first, but she sometimes actually misformed them. The "a-r-o-*m*-d" above is what her word looked like, but her error was probably the omission of one loop of the "u" or of the "n." Such omissions were fairly frequent at first. The reversal of letters, as in "chiar," was also frequent. She often erred in spelling by omitting letters. It will be noticed that she left the "s" off "perhaps" in the section quoted. She also used an abbreviated form of expression, as the predominantly expressive patient so often does, and omitted many of the words which would be necessary for normal sentence construction. This tendency is clear in her letter and throughout later examinations. The confusion in the last part of the letter above may have resulted to some extent from verbal omissions, but is probably a more complex change with verbal and structural errors as well.

In *writing to dictation* at this time the patient's scores fell considerably below the lower quartiles for the normal group (Morrison McCall Spelling Scale and Stanford Achievement Dictation Test). Analysis of her errors showed a large proportion of letter omissions but not larger than the average for the aphasic patients. It was evident that the abbreviation in her spontaneous writing was chiefly a matter of verbal omissions, and that it did not carry over to writing to dictation and did not extend very markedly to letter and syllable omissions as in some cases of aphasia.

Arithmetic. The patient's relatively satisfactory understanding of spoken language at this time was demonstrated again in the arithmetic studies. She understood questions involving number words and responded correctly to them. For example, she was able to tell the number of days in the month, and explained that there might be thirty, thirty-one, or in February twenty-eight. She had a good grasp of number series, and was almost always able to say or indicate in some manner the number coming before or after a given number. She also understood the relational meaning of numbers, and could say which was the larger or smaller.

She did simple oral arithmetic computations correctly for a few minutes but soon began to fail on an increasingly larger number, saying that she "couldn't think" any longer.

Performances on language intelligence tests. The fact that the patient's difficulty lay rather in producing words clearly and accurately than in evoking them was evident from the results of the language intelligence tests. On *controlled association tests,* the Oral Opposites and the Oral Analogies, she was below normal medians in the number of responses she gave correctly, but not much below her educational level. On the Opposites Test, however, where her responses were timed, she was far below normal in speed.

Her limitations in understanding were clear from the results of the *Oral Absurdities Test,* where her score fell among the poorest of the normal scores. Her responses, handicapped as they were by her difficulties in expression, sometimes showed that she grasped the actual words of the statement without being able to develop its full significance.

Non-language performances. At this examination just after operation, there was no time for non-language studies. Only two tests were made: the Stanford Binet Designs, which No. 24 was able to reproduce only well enough for a half credit each (failure at Year X); and the drawing of a man. Scored on the Goodenough Scale, the latter fell below the lower quartile of the normal scores. The drawing was not only childish in its conception, but absurd in its proportion and very incomplete.

Second Psychological Report

Speaking. When No. 24 was examined seven months later, she was able to speak a little more easily and consequently attempted to speak more, but the product itself showed very little improvement. She still spoke rapidly, certainly more rapidly than most patients who have difficulty in articulating. She seemed even more rapid than the normal average, but her speech was so confused that no measurements of number of words per minute could be made.

Analysis of her errors showed great variability according to the particular context, the related sounds, the structure of the word, and so forth, but from the point of view of defects in articulation alone there were certain general tendencies. A marked and persistent type of error was the overstressing of some of the consonants, perhaps as a result of the effort in speech production. Thus an "r" would be trilled for an abnormal length of time so that "very" became "verrrry"; and a sibilant "s" would become a prolonged hiss. A second type of error was the confusion of vowel sounds, but this was comparatively infrequent and showed no regularity. Consonants were more often confused, and the errors showed greater regularity. Apart from those which seemed to be dependent on the nature of the total word or phrase, almost all of them were confusions of related consonants, that is, consonants for which the positions of the vocal organs were similar. Thus the vibrated "d" would be interchanged with the unvibrated "t," the "b" with "p" and even with "m," the "g" with "k," and so forth. It is important to note that the changes did not occur in only one direction but in both, that is, the unvibrated sound took the place of the vibrated as well as the other way around. There were also other confusions between sounds less closely related, as "ch" and "sh." Both of these sounds were difficult for her. Finally, there was a tendency to omit one, and usually the second letter of a double consonant so that "shine" became "sine," "bread" "bed," "soft" "sof," and "ring" "rin." All these errors decreased as her speech improved, but even after she had made great progress the nature of the disturbances remained the same.

The patient could now say *automatic word series* more readily than before. She counted and gave the names of the days of the week fairly clearly, the latter in 6 seconds. For the months she required 15 seconds and her articulation was poorer. She said the alphabet correctly to "m," but failed beyond this, not only because she could not produce the letter sounds, but because she did not know the series. One failure was "m o s p r e t" and another, with several reversals, "m p l s r u t w s y z."

She said that she knew the Lord's Prayer, and tried many times to repeat it, but very few fragments were distinguishable.

Her articulation was slightly better when she sang familiar songs than in spontaneous speaking. She was able to carry tunes fairly well and liked to learn new songs which she heard over the radio. When alone, she kept the radio turned on most of the time because the music "cheered her up."

Naming. No. 24 had had no difficulty in naming objects, colors, or line drawings just after the attack and showed none at this later examination. She still articulated the names poorly and sometimes misformed them.

Repeating. She could repeat words and phrases slightly better than before. Her errors remained the same in nature; they were similar to the errors of spontaneous speaking but less marked. In other words, when the examiner set the word or phrase to be pronounced, the patient had less difficulty in articulating and forming it. Occasionally, however, she became very much confused in repeating a complex word such as "elaborate," and even with many repetitions would not be able to get it correctly until the examiner divided it into syllables.

Understanding spoken language. The patient's understanding had improved during the seven months. She no longer made errors in following two- or threefold directions. She had no difficulty understanding conversation, even when several people were talking with her. The adequacy of her understanding was further demonstrated by the fact that she enjoyed listening to songs and talks over the radio. Her only limitations now appeared in grasping complex statements such as those of the Absurdities Test.

Reading. During the seven months after the attack No. 24 had made more improvement in pronunciation of words in *oral reading* than in other speech responses. She pronounced about 50 of the 100 graded words of the Gates Pronunciation Test clearly enough for a plus score. Less improvement was noticeable in her pronunciation of words in connected text, but even here her articulation was better than in other speech responses. On the whole, she was below the poorest of the literate normals in both the rate and the accuracy of her oral reading.

On tests of *reading comprehension* her performances were slightly higher than they had been before (Pintner Toops Revised Directions Test and Gates Primary Reading Tests). She now attempted two other tests, on each of which she had some success, but her scores fell considerably below the lower quartiles for the normal group (Thorndike McCall Reading Scale and Chapman Unspeeded Reading-Comprehension Test).

Writing. Since leaving the hospital No. 24 had sometimes written letters to members of her family, using of course the preferred right hand. She was now persuaded to begin using the left, and to write something every day and save it for the examiner's next visit. She learned to use her left hand very quickly; within a few weeks the writing was clearer, though slower, than the right-hand script. She soon began to write at great length, giving the examiner from ten to twenty pages a week, for she found that the writing not only improved her hand, but calmed her "nerves."

As a comparison of the following extract with the letter quoted in the First Psychological Report will show, the quality of her *spontaneous writing* at this time was better than it had been seven months before.

> 20/11/32 hope to get new news of Elmer (her son) wish could see my boys
> like to see my boys soon. . . . I get my glasses fix*es* need the*n* pretty quick.
> do
> born on July 7, 1886 Wilmington Delaware, I cant left hand str*ait* lines

The occasional letter and spelling errors persisted and the product was much simplified and abbreviated, but there were no changes or confusions serious enough to make it incomprehensible. From this time on her most serious errors in writing were the verbal omissions. She occasionally made some remark which showed that she was conscious of omitting some of the "little words."

Tests of *writing to dictation* showed that there had been a clear improvement over the seven months' interval, but her scores were still below the lower quartiles for the normal group (Morrison McCall Spelling Scale and Stanford Achievement Dictation Test). Analysis of her errors again showed no striking differences from the average findings for the aphasic patients.

On the *Oral Spelling Test* she was able to give only as many words correctly as the poorest of the literate normals. Her difficulty was not only in spelling but also in articulating the letter sequence even when she knew it. She spelled only seven words of the list aloud correctly, but could write fifteen of them.

Studies of *copying* showed that she was slower than normal, particularly when using the left hand, but that she made only occasional errors. These resulted from the fact that she did not copy letter by letter, or even word by word, but read a phrase and, if the material were at all familiar to her, proceeded then to write it as if she had been writing spontaneously.

Arithmetic. On *arithmetic computations,* No. 24 fell far below the lower quartile of the normal group. She confused the signs + and ×, and she made mistakes with computations involving three-place numbers (Stanford Achievement Arithmetic Computation Test).

She stood higher in relation to the normal distribution on the printed *arithmetic problems* (Stanford Achievement Arithmetic Reasoning Test). Her performance showed that she was fairly well able to determine the nature of the process from the conditions of the problem.

Performances on language intelligence tests. On the *controlled associa-*

tion tests used at the earlier examination, the Oral Opposites and Oral Analogies, No. 24 now gave a few more correct responses, but her scores were still below the medians for the normal group. She did slightly less well on the printed forms of the two tests. She gave the responses far more quickly than she had before, however, and her speed scores on both Opposites Tests were slightly above the medians for the normal group.

On the *Sentence Completion Test,* which she now attempted for the first time, she completed the easiest sentences quickly and correctly, but began to fail very soon. She seemed to attack the sentences piecemeal, and would consider possibilities for one blank rather than the significance of the whole.

On the *Oral Absurdities Test* she did only slightly better than before, and her responses to the Printed Absurdities were no more satisfactory than to the oral. It was still difficult for her to express an understanding of the absurdity, but some of her responses showed definite evidences of inadequate comprehension. A case in point here is the response to the statement: "When there is a collision the last car of the train is usually damaged most so the guard thinks it would be best if the last car were always taken off before the train starts." She said:

> It won't go at tall then. (Explain that.) Ebery time I trawel sometin' happen . . . den . . . one time dey trow two sleepers off. (But what was foolish about what I read?) You say taka lass cars out . . . won't happen . . . train won' go at all then.

On both oral and printed *vocabulary tests* her scores fell in the lowest quarter of the normal scores (Stanford Binet Vocabulary and Thorndike Test of Word Knowledge). In relation to the normal distributions she did slightly less well on the printed vocabulary test, where she had to choose that one of five printed words synonymous with a given word, than on the oral where the test word was pronounced for her and she had then to indicate her knowledge of it verbally.

Reproduction of verbal material. No. 24 was below normal in repeating numbers, letters, words and sentences, and her difficulty was not simply in articulating and forming the words correctly. After oral presentation, she could give five digits, four letters, and four disconnected words. She could repeat sentences of sixteen to eighteen syllables with no errors other than those in articulation and word-formation, but when she attempted longer sentences she omitted and confused words as well.

Non-language performances. These performances fell near the lower quartiles for the normal group. In comparison with those of other cases of aphasia, except for the very severe cases, they were remarkably uniform. The only performance which excelled the normal median was that on the Seguin Formboard where speed of movement is a very important factor. This was interesting in view of the patient's rapid speech and quick responses on the controlled associa-

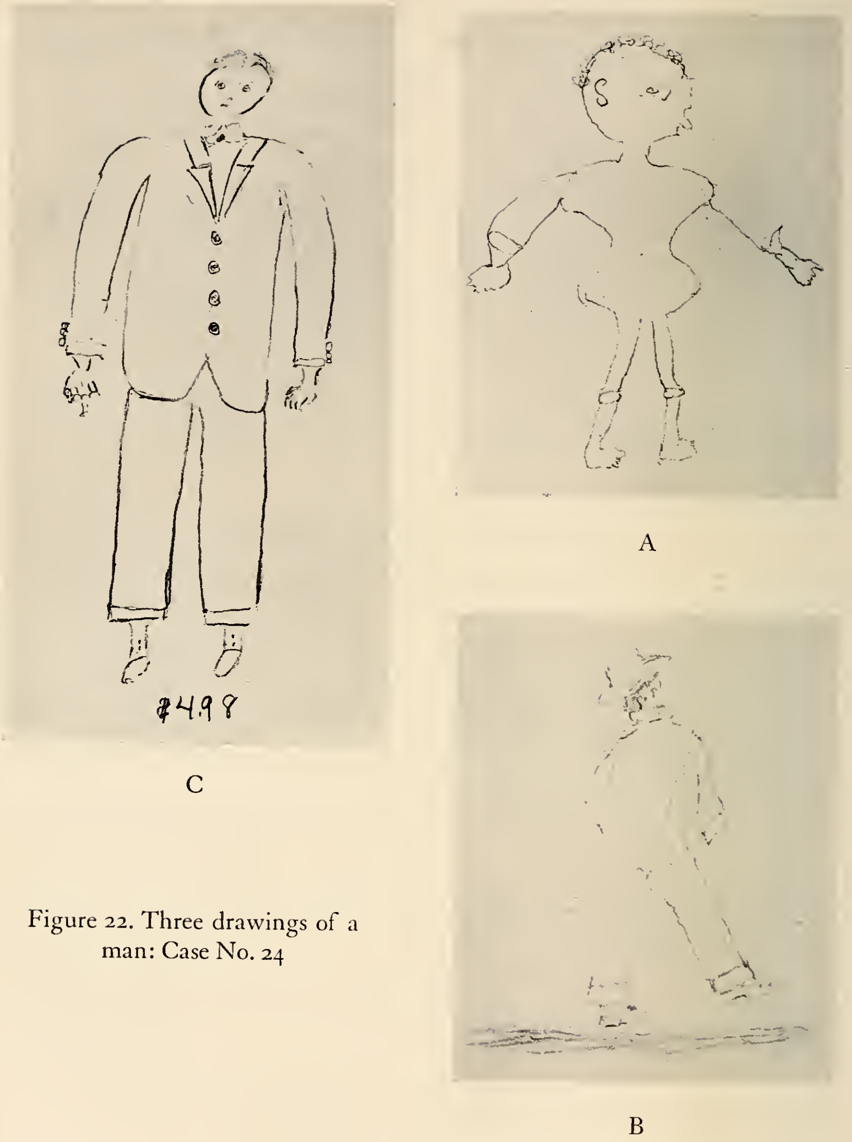


Figure 22. Three drawings of a man: Case No. 24

tion tests. There seemed to be sufficient evidence to show that she was a person with very quick reactions. She herself thought this to be true, and claimed that she had been a rapid worker on the glazing machine and had made good money at piecework.

On the other formboards of the Shorter Pintner Performance Scale where speed of movement was probably subordinate to perception of form and intelligent planning, she did less well, falling near the lower quartiles in both speed and qualitative scores.

On both *Picture and Drawing Completion Tests,* her scores were below the lower quartiles for the normal group. She made no absurd completions, but she was satisfied with inferior responses. On the Imitation, the Picture Reconstruction, and the Reversed Drawing Tests of the Pintner Non-Language Scale her scores also fell just below the lower quartiles.

When she attempted *Digit-Symbol Substitution Tests* with the left hand her performances were very poor; with the right hand they were close to the lower quartiles for the normal group. Her performance on the long Woodworth Wells Substitution Test was interesting as an evidence of learning. The length of time she required per line decreased almost continuously and she referred less and less often to the key at the top of the page to determine which number to put with which symbol.

In *reproducing figures* immediately after presentation she was far below the medians for the normal group (Kuhlmann Test of Immediate Recall). She made many errors and she was much slower than the normal in drawing the lines.[9]

Her *drawing of a chair* showed fairly good proportions and great care for details, but was totally lacking in perspective. Her score was slightly above the lower quartile for the normal group.

Her drawing of a man was an improvement on the one she had made at the first examination, with better proportion and a little more detail. As so often happened, however, the nature of the drawing was exactly the same as before. Scored on the Goodenough Scale, this second drawing was slightly above the lower quartile for the normal group (Figure 22, A).

No. 24 traced the *Porteus Mazes* slowly and carefully but made a very low score none the less. It fell among the poorest of the normal scores and that for a second test six months later was only slightly higher. From her care in the work it would seem that she was unable to make adequate visual analyses of the mazes. Another possibility is worth noting, however. If the test is here, as Porteus has said it to be, an index of "foresight" and "planning ability" with implications as to practical and social behavior, then her low score fits very well, for this patient had never been able to plan her life with average foresight. She bore up well under poverty, but as soon as her husband was employed for a month's work, she moved to a larger apartment and bought new curtains and new clothes. The "hope-for-the-best" spirit which sustained her so well in times of emergency had its drawbacks from the point of view of sagacious planning.

---

[9] In view of the fact that her performance here was so poor, it was checked by other tests—series of figures from the Gates Visual Memory Test, Ellis' ten graded geometrical figures, and specially constructed forms. The patient almost always failed to reproduce any but the simplest figures correctly. Her errors showed no regularity, that is, no consistent tendency to omit parts of figures or to simplify figures. Like the normal she often named a figure according to its general shape, for instance a K, and then drew hers more like a K than the original. She was able to copy exactly although not skillfully the complex figures which she had not reproduced correctly from memory.

Third Psychological Report: Summary of Training and Progress

Seven months after her discharge the patient sent for the examiner through the social service department of the University Hospital, and asked to be taught to speak better. She was discouraged and depressed because she did not think she had made any progress since leaving the hospital. She seemed perfectly confident that the examinations in the hospital had helped her speech and was anxious for further training. Her attitude, together with the fact that she had been examined immediately after the attack but had received no training for seven months, made her a most satisfactory case for reeducation.

Unfortunately the examiner had not sufficient time to give thorough training, and since only one or two hours a week could be spared, it was decided to concentrate on improvement in speaking, for this was at once the language process most seriously disturbed and the one most essential to her welfare. In addition to the hours spent with the examiner, she was asked to do a certain amount of practice work every day, and she faithfully did what she was asked and more.

Except for the introduction of variations which would break the monotony, the training was not changed much. It consisted largely of the four types of work outlined in the following paragraphs.

1. Specific training was given in the articulation of the sounds most difficult for the patient to pronounce. She was shown how to take the correct position for these sounds, and drilled on simple words in which they occurred and longer words or sentences useful in differentiating the particular sound from related sounds. It may be noted in this connection that she was almost always able to take given lip, teeth, and tongue positions at command or by imitation if she were not attempting to pronounce a certain sound. If she were, she often failed to take the position correctly. This training in the production of speech sounds was useful in overcoming specific difficulties, but relatively unimportant in comparison with the other practice work.

2. A group of approximately ten sentences was given to the patient at each lesson with instructions for her to "copy the sentences, writing with the left hand and saying each word aloud" as she wrote it. She was also asked to read the sentences aloud slowly before she copied them and her ability to read them was checked when they were given to her, and again at the next working pe-

riod. Great emphasis was laid on slowness in reading, and also in all her attempts at speaking. Each group of sentences was constructed to provide practice in some particular speech sound or sounds, or to include words which she found difficult to utter. The sounds which caused her most trouble were introduced again and again in new series of sentences.

3. Lists of ten or fifteen polysyllabic words were made, and she was directed to write these words, putting hyphens between the syllables and saying each syllable aloud as she wrote it. After a number of exercises of this type, when familiar words were getting scarce and more difficult ones were introduced, she spontaneously used her dictionary to find out how the words should be divided.

4. She was asked to read newspaper reports or magazine articles and then to write a short account of what she had read, always writing with the left hand. Because the training periods were so few, however, these abstracts were not corrected for spelling or even for sentence structure. They were used simply for the practice which they gave in purposive reading and in the reformulation of the material. A variation of this type of practice was introduced by having her report what she heard on the radio. She enjoyed this; but instead of reporting either what she read in the paper or heard over the air, she often preferred to write or tell the more exciting events of her own daily life, and she was allowed to do so without check, for the reports of her own experiences gave her just as much practice in expression.

The progress made in the seventeen months of training has already been indicated to some extent. No. 24 has improved greatly in the articulation of specific sounds and in the general quality of sound production. Furthermore, she has been able to slow down her speech, and this is an important factor in making it more intelligible. At its best, however, her speech is still imperfect; many sounds are inaccurately produced and many words slurred. At its worst, when she is excited and speaking rapidly, part of it is still incomprehensible. Her progress has been not only in the production of sounds but in the correct formation of words. When she utters a misformed word she is now almost always able to stop and correct it. She learned to write with the left hand very quickly; her handwriting with the left is more legible than that with the right, but it is a less formed and more childish script and still slower than the right.[10]

The structure of both spoken and written expression is far more complete and the vocabulary more extensive. The extent of the improvement may be judged by a comparison of the following passage from one of her letters, which is typical of her writing after twelve months of training, with the passage quoted on page 401 as an example of written expression before the training was begun.

---

[10] It is worth noting that some of this patient's errors in writing, and also in speaking, were reversals of letter or syllable sequences, but that the proportion of errors of this type has not changed from the first tests when the right hand only was used until the present when the left hand is used altogether for writing and part of the time for drawing, and when she occasionally finds herself eating with the fork or spoon in the left rather than the right hand.

> I wore the yellow linen dress trim
> in dark brown I sure enjoyed
> my self at Dots birthday party
> I danced with Dots Brother in-
> law, and Myrtles husband, they
> are swell dances Mr B——
> is one of the old time dancer
> John R—— is latest style[11]

The improvement in test performances which can be expressed in terms of the variability of the normal group is represented graphically in Figure 21, page 394. Reference to this graph will show that there was great improvement in the first six months of training in reading comprehension, oral spelling, arithmetic, the performances required by the Sentence Completion and the Absurdities Tests, and in vocabulary. As was to be expected with the more satisfactory speech production, the quality and speed of oral reading also improved, but the extent of the improvement does not show in the graph because the patient's performance was still far below the normal range. In the next six months of training, although the progress in speaking continued, there was much less change in other performances. This condition is evident from the graph, where the levels for the third and fourth examinations fall very close together. The only marked improvement during the second six months, aside from that in spontaneous speaking and writing, was in oral reading and reading comprehension. This condition was interesting for these were performances which were being trained.

---

[11] Later in the course of the training the patient's sister found and returned to the patient a letter which she had written to the sister about a year before the attack. It is an important record because it shows an abbreviated form not unlike that of the letters written in the second year after the attack. It demonstrates that the patient's original expression in writing was inferior in relation to the performances of the normal group, and that the gain made in the period after the attack brought her approximately to her former level. About half of the letter follows:

Phila Pa April 23

Dear Sis.

Klemm (One of the patient's sons.) is sure waiting for Friday said cant you make bed for me on floor anyway we wont sleep we ll play cards all night he sure waiting guess you ll have to take him to moving picture or somethig as Andy says on Radio

Ellin came over Tuesday night wouldnt eat cause she just got up from tabel her and Klemm went down to —— house Nelson (The patient's husband.) went down after I done dishes and he read paper

……

Klemm said Mabel (The sister to whom the letter is written.) and I will clean the windows if colored girl dont come. he expect to do lots but nothng only devil with you well so long we are all especily Klemm seem he awful anxious

Sis Lil

There was little difference between the results of non-language tests from the second to the fourth or the third to the fourth examinations. Performances on these tests were probably less affected in the beginning and consequently changed less. There was improvement in drawing, however, and this seemed to be a direct result of practice. After the drawing tests, the patient became interested and practiced copying figures from magazines and sketching people who sat near her in the park. She did not of course learn to draw, but she made considerable progress, the extent of which may be seen from a comparison of the three drawings in Figure 22. The first is her drawing of a man on the second test eight months after the attack; it was a little more complete than the first drawing seven months before, but essentially the same in nature. The second is a sketch which she made in the park seventeen months after the attack, and the third a test drawing of a man made two years after the attack. The spontaneous drawing differs from the test drawings in that it was made from a model, although the model seems to have been temporary, and it probably also reflects a different attitude. The three, however, are sufficient to indicate progress.

As already noted, the tests for the fourth examination were made during a time when No. 24 was worried and excited by many personal difficulties, and therefore the results may not indicate her highest performances. It is probable, however, that even under the best conditions, she would not make much more progress on either language or non-language intelligence tests. Her progress in speaking, oral reading, and all other responses dependent upon satisfactory articulation and word-formation, and also in writing and in reading comprehension, have continued up to the present and may continue further.

3. RESULTS OF TRAINING

As in the case just reported, attempts at reeducation were hampered by the fact that not enough time could be given to the individual patients. All of those trained would have profited by more frequent work periods, particularly after the practice had been well started and the patients were strong enough to work steadily. Those who received the most satisfactory training from the point of view of number of hours per week and length of total period were the following:

No. 4, expressive (Chapter VIII) 3 hours per week for 9 months
No. 31, receptive (Chapter IX) 2–3 hours per week for 5 months
No. 24, expressive (Chapter XVI) 1–2 hours per week for 17 months
No. 10, expressive (Appendix I) 1–2 hours per week for 12 months
No. 33, expressive (Chapter VIII) 1–1½ hours per week for 30 months

In addition to these, other cases were trained in particular performances for shorter periods, and yield interesting data on the results of specific drills. An example is No. 28 whose case is reported in Chapter IX; he was given some training in arithmetic, practiced for two weeks, and showed marked improvement.

Four of the group of five cases who had prolonged training were expressive, the fifth was receptive. None of the amnesic cases was reeducated; four of these were tumor cases where the pathological processes were working against improvement, and the fifth was a case where the draining of a temporal lobe abscess resulted in rapid recovery during which observations were made but no specific training was given. No training was attempted in the expressive-receptive cases for it seemed obvious that even if any progress could be made it would require a great deal of time which the examiners were unable to spare from the major work of making the original studies.

The results of the training have already been presented in the case records for Nos. 4, 24, 31, and 33. Of these No. 4, the professor of Romance Languages, was probably the most interesting patient. His reeducation was begun, as described in his record in Chapter VIII, two months after the attack and continued for between nine and ten months. Since he was not examined immediately after the attack, there is no means of estimating his improvement in the first two months. His family's reports indicate that there had been progress, and psychological examinations made in the fifth and ninth months after the attack showed that the progress continued. The question as to how much of this progress resulted from the training cannot be answered definitely, but there is this significant fact: a comparison of the patient's condition just after the onset with the findings of the first psychological examination indicates less change than that which was manifested between the first and second examinations. In other words, it seems that the rate of improvement increased around the third and fourth months, a condition which is undoubtedly to be attributed to the training. Thereafter the improvement slowed down, in spite of the training, but was still apparent when the examination was concluded about a year after the attack. There is of course no way of determining whether or not the training prolonged the improvement.

The progress in this case has already been discussed in Chapter XV and in the record in Chapter VIII and represented graphically, so far as that was possible, in Figure 1 (page 162). The tendency for the improvement to be most marked in those performances at first most seriously disturbed meant that the greatest changes occurred in articulation, in adequacy and fluency of expression, and in responses to some of the language intelligence tests, particularly the Sentence Completion, which involved constructive mental activity. The performances drilled, as described in the case record, were just those designed to improve articulation and the complex processes of spoken and written expression. In so far then, the greatest improvement occurred where training was given. Reference to Figure 1 will show, however, that there was some improvement in almost all performances. In oral reading, reading comprehension, and spelling this might also have been to some extent the result of the training, for these performances were a part of the practice work. In arithmetic, however, there was marked improvement between the first and the second examinations, with no other training than that from taking the tests and no incidental practice other than the writing of checks for household expenses, etc. Similarly there was improvement, although less generally, on non-language tests, with no other training than that derived from taking the tests themselves. The results for the other patients will be presented before the basis for such improvement is discussed.

No. 31 was another extremely interesting patient, a lawyer of originally high intelligence and great language facility. As outlined in his case record in Chapter IX, his training was like that for No. 4 in its concentration on complex performances, but adapted for the receptive as well as the expressive difficulties. No. 31 was given a thorough examination which lasted from the second through the sixth week after the attack, but no specific training was introduced until six months later when he was more stable emotionally. The following five months were then his best months and the training was given during this time. At the anniversary of his wife's death, a tragedy which had precipitated his attack, he again became extremely disturbed and attempts at reeducation were given up. As noted in the case record, work was broken off so suddenly that no examination could be made to determine the amount of progress during the five months of training. The only judgment possible, therefore, is that on the basis of the weekly records of practice work. These showed that the patient had improved considerably during this period in his understanding of spoken language and of printed material, and also in the fluency and correctness of his expression in speech and writing. None of this improvement, however, was so great as that which had occurred during the first seven months of the disorder. The patient was examined once more nine months later, and twenty months after the attack, and this study showed comparatively little change. Of the case as a whole, therefore, it is possible to say that improvement continued from the seventh through the eleventh month when training was being given, and that little improvement occurred after this time. It is not possible to determine whether the training increased the rate or amount of progress, or whether the absence of training or the disturbed mental condition or both were responsible for the lack of progress after the eleventh month.

The other cases in which prolonged training was attempted, Nos. 33, 24, and 10, are alike in that their greatest difficulties appeared in articulation and word-formation, and in all these cases the training was concentrated on expression in speaking. No. 24 was the only one examined immediately after the onset and then later, before and during the training period, and she is consequently the only controlled case where the effect of training can be judged decisively. The evidence in all the cases, however, goes to show that speech can be improved by training, both in respect to articulation and in the more complex processes of language expression.

In none of the five cases was the improvement sufficient to raise the patient to what must have been his original level, and in all cases some particular difficulties such as defects in articulation persisted. These, however, were less frequent than they had been before the training and they could often be corrected more easily. In cases No. 10 and No. 33 the progress was confined almost entirely to speaking and various other performances requiring spoken response and so profiting when articulation and word-formation improved. In other words, these two patients showed specific improvement where the training had been given and not a general change affecting many performances. It is worth noting that one of them, No. 10, had had only a third-grade education and had never been proficient in reading, writing, or arithmetic, while the other, No. 33, had had only a year's schooling and could neither read nor write. Furthermore, in his case the disorder was of more than five years' duration when the training was begun.

The other three patients showed progress in many performances in which no training was given and no practice other than that resulting from the periodic examinations. The examinations themselves, however, are undoubtedly factors making for improvement. They actually furnish some slight amount of practice and in addition they direct the patient's attention to the field in question; as his conversation shows, the experience returns to his mind occasionally, and he may even spontaneously arrange similar problems from the situations connected with his everyday environment. Thus several of the patients were interested in the drawing and drawing completion tests, and began to copy figures from magazines, and No. 24 even attempted sketching in the park.

The taking of the examination itself could account for only a small part of the improvement in performances which were not trained as shown in cases Nos. 4, 24, and 31. The situation is really very complex. The examinations are so given that the patient looks on most of them as a part of the course of reeducation. From the very beginning his attitude is altered: he comes to regard the language disorder as a difficulty to be attacked by certain specific types of practice, a concrete problem which is within his power, and consequently he begins to look for and work for progress. This change in attitude accounts for some of the general improvement. Beyond this, there are two other factors, both of which are probably operative in most cases—the so-called transfer of training and the recovery which is occurring quite independently of training. In all of these patients there was undoubtedly transfer of training in the sense of improvement in oral reading, repeating, and any other performance requiring spoken response as a result of drill in articulation and word-formation. This is really a transfer only where identical processes are involved. Probably transfer also occurs when the actual material is not identical as it is here, but the general learning processes and the methods of attack are similar. These less tangible effects of training may account in part for the improvement in arithmetic which was often observed when no specific drill was given. This improvement, however, also depended to some extent on the progress in speech, for patients were sometimes, though by no means always, misled in their calculations by errors in speaking.

In all of the cases reeducated here, with the possible exception of No. 33, natural recovery was taking place, although its extent could not be measured. The result of the training was apparently to increase the amount of the improvement and possibly to prolong the period over which it occurred, and to increase the amount of improvement in specific processes such as articulation.

4. SUMMARY

The methods of training used in this research were closely adapted to the individual patient, so that they would deal as directly as possible with his particular difficulties and take advantage of the performances still within his power. They included drills in the production of speech sounds, and also of letter forms in writing; practice in articulation through repeating and oral reading; various exercises designed to increase the number of words available for use in spontaneous expression; exercises in sentence construction; and work on the more complicated processes of understanding and expression, notably through the oral or written reporting of passages which the patient had listened to as they were read to him, or had read himself. The material was adapted to the patient's interests, and work was arranged so that he would be encouraged by previous success and stimulated to make new efforts.

Case No. 24, which illustrates the training given when the greatest difficulties were in articulation and word-formation, is reported in Section 2. The results from this and other cases, notably No. 4, indicate that reeducation increases the rate of improvement and aids in overcoming specific difficulties and also in helping the patient to find new ways of achieving the results which he can no longer achieve in the normal manner. In none of the cases where training was given did the patient regain what might have been expected to be his former ability, but in all he made considerable progress and was sufficiently encouraged by his progress to have a different attitude toward the disorder. Thus the training was of value directly for the improvement in speaking and other specific performances, and it was of tremendous value indirectly for its effect on the patient's morale.

XVII

THE PSYCHOLOGICAL CHANGES IN APHASIA

1. Variations in performance
2. Relative success on language and non-language tests
3. Behavior of clear-cut cases of aphasia in the practical situations of everyday life; social responses and attitudes
4. The nature of the aphasic disorders
5. Major conditions underlying the extent and nature of the aphasic disorders
6. Summary

1. VARIATIONS IN PERFORMANCE

THE psychological changes in aphasia most thoroughly discussed up to the present point have been those which differentiate certain types of disorder. From the practical standpoint these are the most important, but from the theoretical standpoint they represent only a small part of the problem. The questions remaining have to do with the general characteristics of aphasia, whatever the type of disorder, and with the extent and nature of the changes in mental functioning which these indicate. Answers to these questions are to be found in the individual case records in so far as the tests and examination methods used in this research have succeeded in disclosing them. In many respects the answers are not complete or decisive and the problems remain unsolved. Nevertheless when the material from the case records is drawn together certain facts appear clearly. This chapter is for the most part a discussion of these facts, with a few excursions into the hypothetical for their interpretation.

One of the facts which stands out most clearly in a survey of the case records is the regularity characteristic of any particular aphasic disorder, whatever its type. In no sense is this statement intended to mean that aphasia is an absolute loss of this or that speech response. It is a complex deterioration which always reveals certain variations in performance. In much of the literature, however, in the effort to establish a functional conception of the disorder these variations have been overemphasized, with consequent underemphasis on the regularity of the picture. The variations fall into two main groups, the first of which includes the daily or monthly variations in performance appearing on reexamination and roughly comparable to the normal variations. The second group represents the variations which depend on differences in the nature of the situation from which the performance arises or in the particular character of the performance itself. These are the variations which were first and most strikingly described by Hughlings Jackson, and which did so much to demolish the doctrine of aphasia as a loss of memory images.

The variations of the first group have already been discussed, particularly in the chapter on the cases of brain tumor. The widely noted irregularity in aphasic performances appears chiefly in the responses to some particular test item, naming a certain object, for instance, or reading a certain word. When the average of a number of such test items is obtained, the aphasic performance does not differ greatly from day to day or month to month unless there are changes in the pathological condition or marked emotional disturbances. When the pathological condition is acute, the variations are of course usually great, but in such cases the variability is not a characteristic of the aphasia but of the disturbed condition in general. In less acute cases there are variations which correspond to the changes in pathology, with improvement or further deterioration as the disease processes decrease or increase. In such cases the regularity characterizing the typical aphasic disorder appears in an orderly regression or progression of symptoms. The course of the disorder varies in rate in different cases and shows certain qualitative changes but there are no sudden and inexplicable spurts and no shifts from one form of disorder to another. The regularity appears not only in the similarity of the average performance from day to day, but in the consistency of the responses of the typical aphasic patient on graded tests. On most tests, particularly the various forms of intelligence test, he passes the easier items and fails with increasing frequency as the items become more and more difficult. His responses are less consistent, however, on tests of reading or spelling single words of graded difficulty. There he often fails some of the simpler words and succeeds with some of the more difficult. Thus it would be impossible to rank the words of such tests in order of difficulty for the aphasic patient as they can be ranked for the normal person or for the cases of unilateral cerebral lesion without aphasia.

The second group of variations, the differences according to the nature of the situation from which the performance arises or its own particular nature, are not variations in the same sense as the above. The variability here does not consist of a different response to the same problem at different times, but of a difference in the quality of the response according to changes in the character of the problem. For instance, as described in many case records, the patient may use phrases in "reactive speech" where they apparently arise more or less automatically as integral parts of the situation, when he cannot use these phrases under any other conditions. Variations occur because the phrases appear in one type of response and not in another, but their occurrence in the one type is a characteristic feature of the case. They arise with a certain regularity whenever the circumstances are suitable. Similarly automatic word series which are produced more clearly or fully than other speech responses are a regular part of the picture. Thus differences in performances of this kind, while they show beyond a doubt that aphasia is no absolute loss of speech response, are still not exceptions to the regularity in the deterioration. They represent a different kind of variation from that appearing in behavior normal for a person of average or near-average intelligence, and they have much to contribute to an understanding of the nature of the changes in aphasia, but they do not speak against the orderliness with which those changes are manifested.

When Jackson discussed these questions, he emphasized differences in the nature of the response, and particularly the difference between emotional or inferior forms of speech and higher propositional expression. At present the basic factors are sought rather in the nature of the situation than in the nature of the response itself, and this point of view seems to be more closely in accordance with the facts. It is evident that the situation must be considered as the total background of the performance, in which the patient's condition operates together with external factors. The physiological condition, the degree of mental alertness, and the degree of cooperation are obviously factors of primary importance in their effect on the performance, and it is only when they are satisfactory that other factors can be evaluated. Foremost among these other factors is the patient's interest, which often seems to facilitate the performance more than any amount of honest cooperation. The effect is noticeable in many types of language response. Patients whose speech is halting and badly articulated may seem greatly improved when discussing a subject in which they are much interested. Others who show severe aphasic disorders and have long been unable to read a newspaper, may still point out names of favorite baseball players and understand and even report the current baseball scores. Many have least difficulty evoking words in connection with their own profession or business, and many, for instance, use legal terms or the names peculiar to the manufacture of some product more readily than words which they need for ordinary conversation. It must be noted, however, that slight differences here are likely to seem great to the patient and that his own opinion on the subject is rarely trustworthy. Interest is undoubtedly one of the factors which lead patients to understand questions about themselves and their immediate situation better than other questions objectively no more difficult. Another factor in all these conditions is the patient's familiarity with the situation. Sometimes the combined forces of necessity, interest, and familiarity are sufficient to enable the patient to continue with his business long after the aphasic disorder has become severe, or to take up work again before recovery is sufficient to bring him to his original levels.

The familiar problems and verbal formulations, of course, do not require the new adaptation which many of the test responses require. To a certain extent they must involve what may be called more automatic responses. The problem of the automatic as opposed to the more voluntary activities is one of the most interesting in the study of aphasia, and one of the fundamental problems for apraxia and agnosia as well. On the one hand, there is Jackson's demonstration, corroborated again and again by other investigators, that the voluntary act suffers when the automatic persists with little or no change. An example from the field of language response is the patient's inability to produce at will words which he may utter readily in reaction to some pressing situation. On the other hand, there is ample evidence of automatic processes which are disturbed out of proportion to the so-called higher mental processes. It often happens that an aphasic patient is unable, for instance, to multiply 7 times 7 although that number combination has come to him for years with very little voluntary effort. At the same time he may devise complicated but satisfactory means of solving the computation through processes of addition or subtraction.

The question of disturbance in the automatic as opposed to the more voluntary performance will require further discussion in Section 4 in connection with the nature of the disorders. For the present it may simply be said that aphasic disturbances appear both in largely automatic responses and in extremely complex performances which are far removed from automatism. Naturally there is no question of two distinct groups, the automatic and the voluntary, nor does any particular performance appear at a definite point on the scale of automatism. It may fall toward the more automatic or toward the more voluntary according to the situation from which it arises, the characteristics of the patient, and so forth.

Nevertheless, for the patients as a group certain types of response can be set apart as relatively automatic. Among the language responses the first type here is the "reactive speech" described in the case records, where the verbal expression comes as an integral part of the patient's direct and immediate reaction to the situation. Examples of various degrees of complexity have been quoted. The patient may say "Hello" when someone enters; "Oh, all right" when told not to do something; or "What did you say?" when he fails to understand. Yet his speech may be so limited that he cannot make voluntary use of such remarks, nor can he repeat them. Furthermore, they are usually superior to his other speech in the accuracy of their articulation.

Similar phenomena are to be found in other forms of speech response such as naming or repeating. In either instance it may be evident that the patient cannot carry through the performance as an isolated problem but can achieve a comparable performance as a minor part of a larger problem. For example, he may not be able to repeat test sentences of as many as six or eight syllables, but he does repeat sentences of this length in an effort to understand directions or commands. In the second case the repetition is not an end in itself but a means to the end which is absorbing the patient's effort. As such, it seems to emerge more or less automatically and probably owes its superiority, as do reactive speech responses, to this condition.

The distinction between the automatic and the voluntary speech responses and the fact that the former may appear when the latter are impossible, are not indications that different mechanisms are involved in the two. The findings do not support Jackson's opinion that the automatic mechanisms arise from activity of the right hemisphere, nor do they support any other division of cerebral areas to account for differences in the disturbances in the automatic and the voluntary. The two are simply different functional aspects of the same activity. An illuminating parallel may be drawn between the reactive speech expressions and the movements of the paralyzed side in bilateral and highly automatic functions such as stretching and yawning. In both cases the response which cannot be carried through voluntarily as an isolated performance can be achieved as an integral part of a larger and more or less automatic performance.

In the so-called emotional expressions the important point is again the nature of the situation from which the response arises rather than the response itself. It need not be emotional in character but it develops from a situation which has aroused emotion. Thus the patient whose speech is usually limited to one or two words, may not only swear volubly when angry or excited, but may produce some statement which has not in itself an emotional character, as, for instance, "No, I can't do that!"

Automatic word series form another type of speech response which is often superior to spontaneous speaking, and the basis for the superiority is to be found rather in the nature of the response itself than in the nature of the situation from which it arises. The initiation of these series requires a definite voluntary adjustment, but for persons near the average in education and intelligence, the series once started tend to be completed more or less automatically. Although it is often less well established, material which the patient has learned by heart is like the word series in this respect.

It lies in the nature of the written response that there is practically no reactive or emotional writing comparable to the reactive and emotional responses in speaking. In cases of prolonged absence of speech, it would be interesting to discover how far written responses appeared as natural and immediate reactions to some situation. The chances are that they would play little part as long as vision was retained and gesture possible. Usually the most highly automatic written response is the patient's signature, and this is often fairly well preserved in cases of aphasia where other written products are lacking or indecipherable.

The reactive and emotional expressions and the automatic word series show that under certain conditions responses are facilitated and brought to levels the patient would not be able to attain under other circumstances. Analysis of the records shows, too, that some of these factors operating to facilitate the responses may at times have the opposite effect, so that the response is made more difficult or even impossible. Thus emotional excitement may facilitate the performance or may constitute a serious hindrance. The antithesis in this case, however, is probably only superficial and the difference may depend on differences in the force of the emotion and the adjustment within the patient's power. The emotion facilitates the production of short phrases and sentences which the patient could not utter under ordinary conditions, and the swearing and statements of protest are at least to some extent means of adjustment to the disturbing situation. When the disorganization is greater, the emotional force is likely to be stronger and the situation one where no satisfactory or even partial adjustment is possible.

The effect of the complexity of the performance may also differ in different cases. It has already been noted that a response may be relatively easier when it comes about as a minor part of the patient's attempt at some larger problem. Even more frequently, however, the opposite situation appears, and the greater complexity leads to greater difficulty in each partial performance than would have existed if these had been carried through separately. There are many examples in the case records. For instance, No. 16, a patient whose most serious difficulty occurred in writing, was fairly accurate in naming printed or block letters. In constructing a word, however, whether by writing or by arranging block letters, he was much less successful in naming the letters properly. The confusion which was so marked in his writing and arranging of the letters seemed to spread over the whole performance, leading to an uncertainty in the identification of letters which was not in itself a primary difficulty. Analysis of the case records does not explain why increased complexity of the performance as a whole should in some cases make part of it easier and in other cases make part more difficult. It is evident, however, that patients differ greatly in the degree of automatism in various responses, and in the role of the automatic in their behavior as a whole.

2. RELATIVE SUCCESS ON LANGUAGE AND NON-LANGUAGE TESTS

In almost every case of the clear-cut aphasic group the disturbances were more marked in language than in non-language performances but appeared in both forms of work. The non-language was sometimes only slightly, sometimes greatly superior to the language. Typical conditions are well illustrated by the three graphs shown in Figures 23, 24, and 25. In each one of these graphs, the patient's relative levels on different performances are represented in terms of deviations from the normal medians.[1] The first represents a case of extensive, though not particularly severe, deterioration, where almost all performances fell below the normal

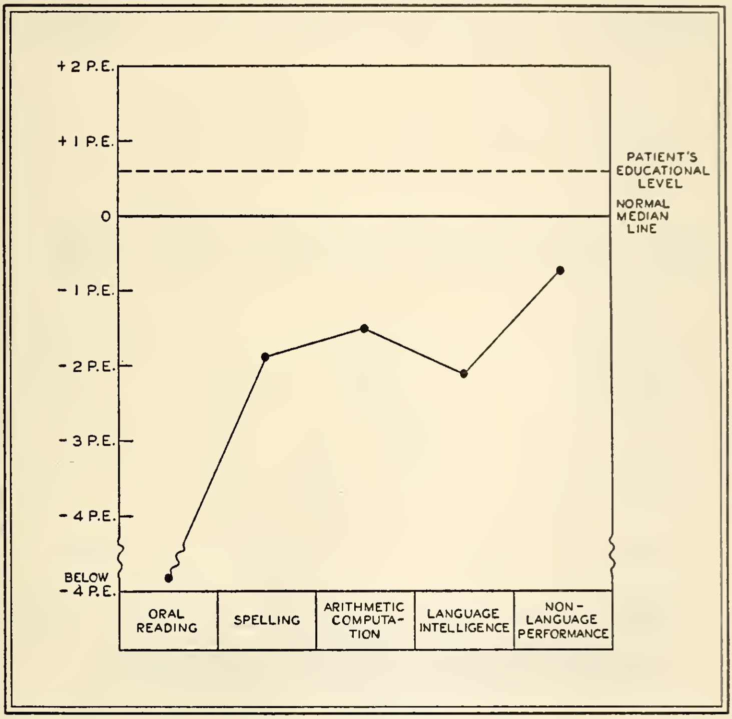


Figure 23. Performance levels (representative): Case No. 58, receptive

medians (Figure 23).[2] As usual, however, the non-language performances were somewhat higher than the language.

---

[1] The graphs, as already stated, are satisfactory except: a) in those cases where the deterioration is so serious that most of the patient's performances fall below the lower limits of the normal distribution; and b) in those performances, particularly speaking, naming, and understanding spoken language, where the normal responses vary so little that they cannot be used as a basis against which to gauge the aphasic.

In contrast to this is the disorder represented by the second graph (Figure 24). Here all language processes were so limited that performances involving language directly fell very low. Only on arithmetic computations did the patient's score come within the normal distribution. Non-language

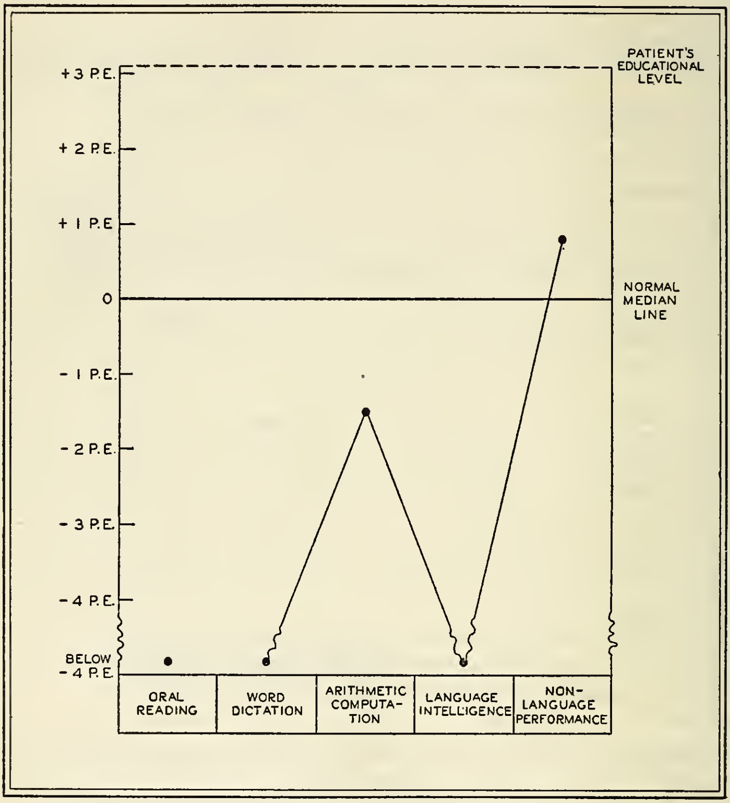


Figure 24. Performance levels (representative): Case No. 19, expressive-receptive

performances, on the contrary, remained high; they may not have equalled what the patient would have achieved originally, but they compared favorably with the medians of the normal group. This case is an example of the type of expressive-receptive patient already described at some length where language as a means of expression or comprehension is almost entirely gone, and yet there remain many evidences of intelligent thinking in non-language work and in the patient's general behavior.

---

[2] The cases represented in these graphs have been carefully selected so that they would be true examples of variations in the nature and extent of the disorder. They were patients of sufficient intelligence and education to have reached much higher levels before the disorder and, with the exception of No. 19, they were examined shortly after the onset.

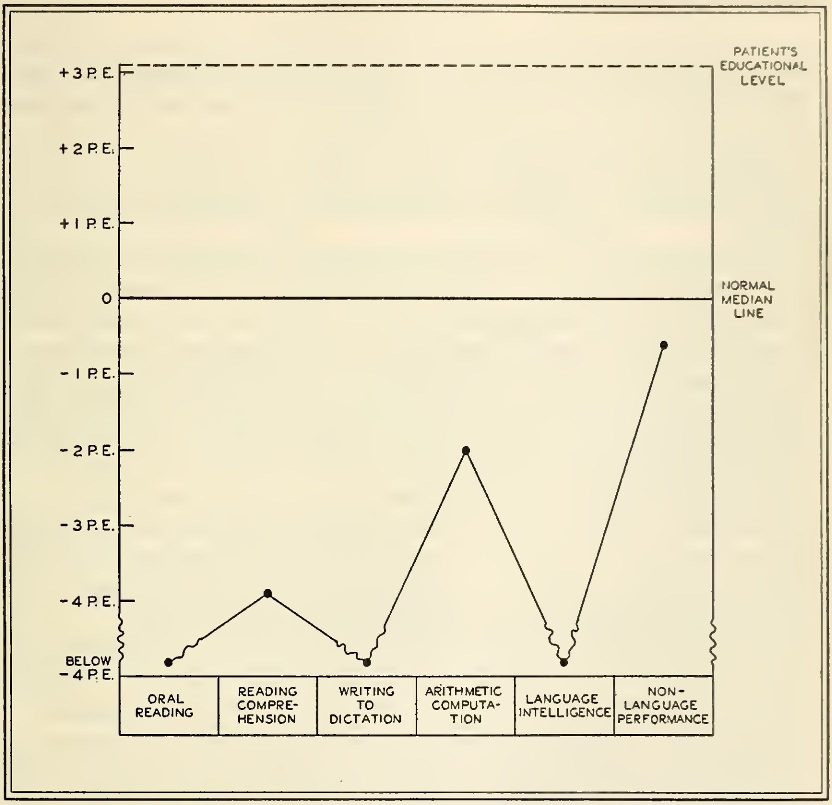


Figure 25. Performance levels (representative): Case No. 31, receptive

A third case completes the picture (Figure 25). Here the disorder was predominantly receptive. Expressive processes were not limited as in the previous case, but were much confused by the verbal and structural errors typical of the receptive disorder; again performances involving language were all extremely low. At the same time the patient did relatively well on non-language tests, and fell only .6 P.E. below the normal medians on a large group of them. The case demonstrates that relatively high non-language performances may exist with great language confusion as well as with extreme limitation in language processes.

Analysis of these three cases and of all the patients in the group brings out a number of facts on the relation between the language and non-language performances which may be stated briefly as follows:

1. There is no constant relation between levels on language and non-language performances which holds for all patients or for patients of any type of aphasia.

2. At the same time it is true that the median of a group of non-language performances in any case is higher in comparison with the normal than the median of the group of language performances. This tendency is to be found in the severe expressive-receptive disorders as well as in disorders of other types.

3. The extent to which the non-language performances are superior to the language varies greatly, from the slight difference in level which is characteristic of most of the cases and which is illustrated in Figure 23, to a tremendous difference such as that shown in Figure 24.

4. The greatest differences between the language and the non-language performances occur in a few of the expressive-receptive cases where the language responses are poor or altogether impossible. Equally high non-language levels, when they appear as they may in other types of aphasia, are naturally not so far above the language because the median language level is higher.

5. Non-language levels may be far above the language in predominantly receptive disorders where language processes are extremely confused as well as in expressive-receptive disorders where there are almost no signs of language.

6. The finer and more decisive analysis of the relation between language and non-language activities and of the problem of language and thinking is a matter for study in the individual patient and the particular performance. Individual differences are such that a so-called non-language performance for one patient definitely involves language for another. Furthermore, each patient may use language symbols or formulations in one of his attacks on a certain problem and not in another.

7. Analysis of individual performances shows that the following conditions all occur, in different cases or sometimes in the same case under different circumstances:

a. The non-language performances may appear to suffer directly as the result of language limitation.

b. In rare cases one or more types of non-language work seem to be peculiarly affected, that is, they show more deterioration than the language disturbances would explain.

c. The non-language response may be adequate when the language response is incomplete. The patient may, for instance, draw an object correctly when he can produce only one of the letters in its name or some fact about it.

d. The non-language response may be adequate when no language response is possible. The patient may draw a picture of an object when he can neither name it nor recognize its name.

e. The non-language response may be adequate when the language response accompanying it is extremely confused.

The facts from the case records show the relation between language and thinking in its great complexity. General statements which will cover the most significant points in that relationship are likely to be superficial or to be held up by one qualification after another. The ultimate conclusions depend upon both the positive and the negative evidence. On the positive side, there are the facts which show the extent to which language processes permeate all thinking and the dependence of some of the so-called non-language performances on verbal formulations or cues. Here must be cited the very important fact that most cases of aphasia show a certain amount of deterioration in non-language performances beyond that which could be explained on the basis of decreased speed of work.[3] This deterioration, however, is not usually so pronounced as the language deterioration. It must depend either on the language disorder or on changes in thinking processes which do not involve language. The facts show that both conditions occur. The so-called non-language work sometimes suffers directly in relation to its dependence on verbal formulations.[4] Sometimes, however, the non-language response shows a disturbance which cannot be explained on the basis of the demonstrable language changes. A disturbance of this nature can be proved only when the language processes are obviously adequate, but it may well occur also when language is limited or confused and consequently seems responsible for non-language failures. The problem is particularly difficult because introspections are usually either impossible or worthless. Even when patients are intelligent and their speech is only slightly disturbed, great care must be taken in asking them for introspections so as not to influence their answers by suggestion.

---

[3] The question of speed in work, whether in language or non-language problems, has not been taken up separately because it is a relatively less important factor than the quality of the work. Slight aphasic disorders may first appear as a retardation in certain language performances, and slowness in speaking and other responses may be the last clear signs of difficulty as a more severe disorder improves. Furthermore, the majority of aphasic patients are retarded in both verbal and non-verbal responses, some of them requiring five to ten or more times as long as the normal to complete a given task. From the point of view of rate of work, however, there is no rule for aphasia in general, nor are there absolute divisions according to types of disorder. Some aphasic patients reach the normal speed in non-language performances and in rare instances in language responses as well. Moreover, analysis of the individual performance often shows that the retardation is the result of some particular handicap such as difficulty in articulating or of the forced introduction of round-about methods of work.

[4] The findings of this study contain many examples of failure in non-language performances which depend on lack of the necessary verbal formulations; but they contain few examples, none of them decisive, of faulty non-language responses which are the direct result of confusion in the accompanying verbal formulations.

In view of the difficulty with introspections and of the disturbances in different expressive and receptive processes which depend upon the pathological condition, it is extremely difficult to approach the problem of imagery. Yet the nature of the imagery which is most accessible and useful to the patient is of great importance both in analyzing the relation of the language and non-language performances and in evaluating the disturbances in different types of language processes. Many of the non-language test problems could be solved by visual or kinaesthetic means without involving logical or verbal formulations. This method is undoubtedly used in some cases, particularly in those next to be considered, where language processes would not be adequate to account for the good non-language performances.

The discussion turns now to what may be called the negative evidence, that which shows a lack of correspondence between the language and thinking processes. Of great significance here are the comparatively rare but striking cases of extensive language deterioration with little or no change in non-language performances, and the frequent scattered instances in other cases of adequate non-language responses when language is obviously inadequate. Conclusions on this point are of course not justified without consideration of the degree to which overt language responses may be taken to represent the full extent of the language involved. Again no statement can be made which applies to the group as a whole or even to all the responses of any one individual. Sometimes a patient cannot produce the correct verbal formulation or the name of the object in question either in speaking or writing, and yet shows by gesture, by partial spelling, or by other means that he has not only a concept of the object, but of the word-form which stands for it. In such cases the satisfactory non-language performance is not so far superior to the language as it is when there is extreme language deterioration. There are cases, however, notably No. 15, described in Chapter X, where both expressive and receptive processes are so limited that the intelligent non-language activities may be assumed to take place with practically no aid through verbal formulation. These are the cases which show the greatest disparity between the language and thinking processes.

A second line of evidence on the negative side, showing a lack of correspondence between language and thinking, is easily and frequently demonstrated in cases of receptive disorder where non-language performances may be satisfactory when the verbal responses accompanying them are extremely confused. Analysis of the examples seems to indicate that the confusion is confined to the sphere of language, and that behind the wrong names or the incoherent explanations, there is a fairly clear concept of the object or the problem. The condition is probably analogous to that which occurs occasionally in the normal person when he asks for a familiar object by a wrong name. It is noteworthy here that his purpose may have been so evident that the hearer understands and responds as he was intended to do, without recognizing that the request as stated was confused. Similarly in other types of work besides the non-language, the aphasic often derives the meaning of the correct response from a confused one. From the point of view of the relation of language and thinking, the importance of the condition is that verbal and grammatical confusion may affect only the formulated language response, when the patient's concept of the object or problem yet remains relatively unaffected and his non-language response is perfectly satisfactory.

In summary, then, it may be said that the pathological material affords ample evidence that language plays a tremendous part in thinking and in intelligent behavior, and that at least in patients at the adult level as almost all of these were, language disorder may effect a marked change in performances which need not depend directly on verbal formulations. These performances may be outside the patient's ordinary behavior, filling in formboards, for instance, or imitating complex and highly artificial movements, so that they are not problems which he has learned to solve by means of language. Nevertheless, language disorder may affect them adversely, for language as a means of thinking has become so habitual throughout the patient's life that it constitutes his customary attack on almost all problems. At the same time it is evident that purposeful and effective thinking may be carried through when language is extremely inadequate or confused, and must therefore depend largely on non-linguistic symbols such as visual or kinaesthetic images. The manner in which the thinking develops varies with the particular problem as well as with the individual patient and the handicap which his disorder involves, but the thinking need not be formulated logically; it extends beyond linguistic processes and is not solely a function of them.

3. BEHAVIOR OF CLEAR-CUT CASES OF APHASIA IN THE PRACTICAL SITUATIONS OF EVERYDAY LIFE; SOCIAL RESPONSES AND ATTITUDES

In considering practical and social reactions, it must be noted first of all that the patients of this group were clear-cut cases of aphasia. In so far as could be determined they showed no other condition known to influence mental functioning, no arteriosclerotic or senile changes or psychoses. Only because the group is so restricted is it possible to study the extent and nature of the changes which may be a part of the aphasia, without the need for estimating how far these changes characterize the aphasia and how far they depend on some other pathological condition. Analyses of the language disturbances in aphasia have often been successful in the past even when the cases were complicated, but the extent and nature of the aphasic changes in general behavior have never been satisfactorily determined on the basis of complicated cases.

The records for the sixty cases of this group show that in the clear-cut aphasic disorders practical and social reactions are, like the non-language performances discussed in the previous section, much less seriously affected than the language. The study of behavior in the practical situations of everyday life and of social attitudes and relationships goes beyond the realm in which present-day tests are immediately applicable and must in any case be based largely on observations of the patient under natural conditions.

Results of such observations have been noted in the case records. For almost all of the patients, reactions to practical situations were fairly adequate. Except for those who were acutely ill, the patients were able to take care of themselves; they fitted into hospital routines well and many of them, including some of the severe cases, were helpful in the care of other patients and in various minor duties. They kept appointments punctually and if they knew the examination was to be continued, had often prepared a work-table and collected a pencil, eye-glasses, and so forth beforehand. Furthermore, they settled themselves to work steadily, and worked with purpose, and in most cases with great patience. Observations of those who lived at home usually gave even better proof than could be obtained in the hospital that practical behavior was little if at all affected. For example, the women who were studied in their homes did all the general housework, including cooking, ironing, dealing with delivery men, and even marketing.

In most cases the simpler social attitudes and relationships were also preserved. The patient failed in many of the ordinary social responses because of his language handicap, but his behavior usually showed that he had retained impulses to make them, to greet people, for example, or to sit in the sun parlor in a group with other patients. Those who had been accustomed to social courtesies such as standing aside for a companion to pass through a doorway first, continued with these habits in spite of severe language disorder. Not only these simple habits but more complex adjustments still remained within their power. They adapted to the hospital staff, to other patients, and to their own families fairly normally, and were strikingly different in this respect from patients with general mental deterioration or disorientation. One of the Philadelphia General patients said of another whose speech was almost entirely lacking and who understood only an occasional word: "He's a sensible fellow." The characterization is excellent; the typical aphasic patient is a sensible fellow, who is able to cope with the routine of everyday life except in so far as it involves language.

The degree to which his former interests are preserved is often surprising. In another connection it has already been noted that strong interest may make the language disturbances appear less severe. Thus the patient may not only retain his interest in so far as the language disorder permits, but through that interest may actually decrease the effect of the disorder. The type of interest is naturally an individual matter, but the wide range in the patients of this group is worth noting. The fields covered were not only the relatively simple and concrete ones in which baseball and certain trades and businesses might be included, but subjects such as antiques, legal questions, and foreign affairs, which were very complex and abstract in their nature. It would be hard to determine whether the patient's reactions in these fields had their normal quality. In all probability they had not, for however great the interest, it cannot bring about a very marked decrease in the effect of the language disorder.

In all the more complex attitudes and traits it is natural that a larger proportion of the aphasic group should differ more markedly from the normal than in the simpler routine reactions and familiar attitudes. The differences showed no regularity, however. There were no characteristic behavior patterns or changes in personality. In reality the problem here is not so much the nature of the aphasic disorder as the nature of the patient's reaction to that disorder. In this reaction characteristic attitudes and traits are sometimes accentuated as they are in various mental conditions. The fearful or gloomy patient is likely to be greatly depressed by his difficulties. The patient whose life history shows that he has weathered many storms cheerfully usually has quite a different reaction; he either feels confident that he will improve and is encouraged by slight progress, or he adjusts himself quietly to conditions as they are.

Close analysis of attitude and behavior in individual cases shows changes which are not typical either of aphasia as a whole or of any particular aphasic disorder. A fairly severe disorder in the early stages sometimes shows a break in control so that the patient swears more than usual and without reticence talks to any observer about all sorts of personal matters. In such conversations one of the points which is likely to appear most clearly is his real opinion of his importance, his value to the company for which he works, and so forth. As he improves he is more careful about his expressions and usually much more reserved. The lack of normal inhibition sometimes appears in the patient's actions as well as in his speech. One patient from a near-by town, who was in a hospital in Philadelphia for many months, became very lonely and used frequently to go to the station at a time when the evening trains were leaving for his home town and look for friends or business acquaintances. Normally he would have inhibited this desire for companionship because his friends and certainly his business acquaintances would think it strange for him to hang around the station for a passing word with them.

Speech or behavior of this general nature shows not only lack of control but a definite lack of critical attitude. The patient's reaction to a situation indicates that he has not taken its whole significance or the closely related situations into account. He may, as one of the patients did, become much concerned about the large number of unemployed and the lack of jobs for them, and yet give no thought to the precariousness of his own job after his absence and disability.[5]

Closely related to this faulty critical attitude is the lack of complete insight into the disorder. It is often evident that the patient's insight into practical situations of his daily experience may be more adequate than into his particular aphasic disorder. All the clear-cut aphasic patients were aware that the disorder existed; they recognized some of its particular characteristics, occasionally with great exactness; but they usually did not realize the extent or severity of the changes. To some degree and in individual cases, the faulty insight was a definite characteristic of the disorder. In other cases it was at least partly the result of circumstances: because of the aphasia and the physical disability frequently accompanying it, the patient usually led a restricted life where old and well-established adaptations sufficed. For example, up to the time of examination, he very likely had no occasion to attempt arithmetic computations. He did not realize how difficult it would be for him to carry on his usual business because he had not tried to do so. The most satisfactory insight usually appears in the simpler cases of expressive disorder, but the degree of insight is not to be determined according to the type of disorder. Furthermore, there is no direct relation between lack of insight and low-grade intelligence, or even between lack of insight and the extent of the aphasic disorder.

---

[5] This is a particularly interesting example because it shows the opposite reaction to that so frequently quoted at present as typical of the aphasic patient, namely, the more adequate response to concrete and personal problems than to the abstract and general.

Of the clear-cut aphasic patients as a group it can be said that reactions to the practical problems of daily life and social responses and attitudes were clearly superior to language responses. The extent of this superiority, however, cannot be defined, for some patients were normal or nearly normal in their practical and social behavior when the language disturbances were severe, while others had difficulty handling practical situations and showed definite changes in attitude and personality traits when language was not very seriously affected. In respect to these variations the situation is thus similar to that found for the non-language performances as determined by tests and the language responses. As to the relation between the non-language performances and responses to practical life situations, it is frequently but not always true that good reactions in one appear with good reactions in the other. There is not so close a relation, however, between the quality of the social attitudes and behavior and the quality of the non-language performances or of the reactions to practical problems under natural conditions.

4. THE NATURE OF THE APHASIC DISORDERS

Aphasia is first and foremost a disorder of language. That is the primary conclusion which the analyses of these cases indicate. But it is not limited to the language processes. In practically every case it clearly involves some deterioration in so-called non-language performances and it also involves changes in the patient's reactions to practical, everyday problems and to matters of social response and relationship. Thus the extent of the disorder varies from one case to another; sometimes there are comparatively limited changes in mental functioning and sometimes widespread changes, but in clear-cut cases of aphasia, there is never a general deterioration.

The nature of the disorder also varies. The problem involves not only the analysis of the disturbances in language processes, whether, for example, they predominate in word-formation or in evoking the word as a name; but also the study of the essential character of the changes wherever they appear. As to the nature of the language disorder, the problem has already been discussed with considerable thoroughness and the different forms of language deterioration have been taken as the basis for the classification of types of aphasia. The next step of the problem is an analysis of the findings from the point of view of the interrelationship between various disturbances in the individual case and the most satisfactory understanding of the essential nature of the disorder.

The greatest advantage which comes from the study of many cases by comparable methods is the correction which the findings in one case impose on the interpretation of another. A hypothesis developed to explain the nature of the changes in some one case is often quickly demolished as others are analyzed. The records for the sixty clear-cut cases in this research showed that aphasia cannot be understood as a unitary disorder, but is rather a poorly defined group of disorders which predominate in language processes but usually extend beyond them, and which may differ considerably in their nature. Apparently the only single hypotheses which could be developed to explain aphasia as a whole are so general as to have little value. Nor is it possible, at least at the present date, to define differences in the nature of aphasia solely according to differences in the type of disorder or in the pathology.

A satisfactory hypothesis must naturally take account of the fact that aphasia is predominantly a disorder of language. On this count there is much to be said for the conception of aphasia as a symbolic disorder. In many if not all cases the most striking disturbances are well characterized by some such term as Head's "disorder of symbolic formulation and expression." This is particularly true of the amnesic patients who show in many forms of language response the same essential difficulty, an inability to evoke the word as a symbol. A symbolic disorder, however, will not account for all disturbances, even in the field of language. As various German authors have noted, an extremely garbled response sometimes has symbolic value when the correct response has not. There were many such instances in the records of the patients in this research. Particularly among those of the receptive type, it was often clear on the one hand that the patient expected a garbled or an incorrectly used word to carry the correct meaning, or read a sentence in a confused fashion and yet understood it; on the other hand, it was clear that he sometimes produced the correct name for an object without recognizing it as such, or read a word perfectly without grasping its significance. The hypothesis of aphasia as a symbolic disorder is even more difficult to maintain when all the disturbances are considered, including those in non-verbal as well as in verbal responses. In the large majority of cases there were changes in non-verbal behavior which could not be explained as symbolic disturbances. There were also frequent examples of the opposite condition, namely, satisfactory non-verbal performances when the accompanying verbal responses were badly confused. For example, a number of patients were often able to make a drawing correctly when they named, discussed, or described it in a form so garbled as to be unintelligible.

A symbolic disorder is therefore not satisfactory as a single explanation of the aphasic changes. It is most illuminating as a conception of the nature of amnesic aphasia, and it holds for various specific language difficulties in other types of aphasia, and perhaps for some few difficulties in outwardly non-verbal responses, but it is not tenable for aphasia as a whole.

Similarly, various other conceptions of the essential nature of the disorder hold fairly well for some cases or some particular performances but not for all. Three which proved useful in this research were the concepts of aphasia as a disturbance of the less automatic and more complex processes and as a disturbance especially marked in creative, constructive mental activity, and the view developed by the *Gestalt* School in which the changes are considered as manifestations of disorder in the *Gestalt* function. None of these views accounts directly, as does the concept of aphasia as a symbolic disorder, for the greater deterioration in language processes. The predominant disturbances in language must be explained on the basis of the higher and more complex development in language than in other mental processes, and the likelihood that the most complex processes would break down first. This explanation is not altogether satisfactory, however, for while language is undoubtedly one of the most complex functions in the power of man, its deterioration in aphasia is no regular regression; exceedingly complex mental processes, both verbal and non-verbal, often remain little changed when simpler processes are seriously affected.

The first view, the concept of aphasia as a disorder of the less automatic and more complex processes, represents the situation satisfactorily in some instances. In most cases it finds support in the fact that "inferior" and more automatic speech utterances often remain when other expressions are impossible. Analyses of the language processes in any but the most severe cases, however, show that in general the most automatic processes do not always remain least affected. In some cases, particularly in the simpler expressive disorders, the opposite condition is nearer to the truth, for the chief disturbances appear in the simpler mechanisms of speech production, the making of correct speech sounds or letter forms. These have been well expressed as the "means" of speech or the "tools" by which language comes into service. It is fair to say that they are relatively more automatic than, for example, the development of sentence structure suitable for effective expression.[6] Cases showing the greatest disturbances in these language "tools" could not be fitted into any conception of aphasia as a disorder of the less automatized language processes. It might, of course, be contended that no such difficulty would arise if the defects in the production of speech sounds and letter forms were cut off from the true aphasic disorders, and either distinguished as anarthria and agraphia respectively or related to the apraxic disorders. There is, as already noted, much to justify a concept of apraxia as a disturbance of simpler and more automatic motor acts, although probably not a disturbance which varies directly with the degree of automatization.

It would be exceedingly difficult, however, to limit the concept of aphasia so that it did not include disturbances in relatively automatic as well as in non-automatic responses. This statement may be supported by many examples from the case records. There are patients, usually of the receptive type, who cannot evoke a necessary word but by paraphrasing give a fairly adequate substitute for it. A similar situation appears in the case of those patients who cannot tell the product of two numbers, although this figure had come to them more or less automatically ever since they learned the multiplication tables, and yet they can work out a system for making a new determination of the product. In the field of speech production itself there is no direct relation between the degree of automatism and the response retained. Some patients, especially of the expressive or amnesic types, can occasionally spell out a word which they cannot articulate as a whole, yet the production of the whole word is certainly the more automatic response. On the whole it is apparent that aphasia is in part a break in the familiar and highly automatic speech responses, and in part a difficulty in the more complex and less automatic processes. Signs of both difficulties appear in almost every case, and indeed in the same disturbed performance. It happens frequently, for example, that a patient starts to write a word normally, but breaks off after the first letter or two, unable to continue the more or less automatic sequence. Such a break often occurs as a normal person writes, but the normal person, if he does not make a second attempt at the automatic sequence, goes back and analyzes the word, applying to the task what he knows of sound-letter relationships, perhaps breaking the word into syllables, and so forth. When the automatic response fails him, the aphasic is frequently unable to help himself by any phonetic analysis of the word. His difficulty is not only in automatic behavior but in the more complex responses, usually far removed from automatism, which are necessary to compensate for the break in the automatic.

---

[6] There are naturally no absolutely automatic speech processes as opposed to non-automatic. The question is one of degree, and there are variations according to the individual patient and the particular response. Furthermore, there cannot be mutually distinct levels of sound-production, word-formation, or speech sound, word sound, and word meaning appreciation. The processes of expression and reception are far more complex than a series of stages of this nature. Disturbances may affect one part of the process more than another but they are never confined to one part. Nor is there any regular development from what are generally considered the simpler stages of the process to the more complex; word-sounds, for instance, may be perceived wrongly but interpreted correctly.

In several of the cases in this research and particularly in Case No. 4, the interesting patient of the expressive type reported in Chapter VIII, the nature of the disorder seemed to be best understood as a difficulty in constructive and creative mental activity as contrasted with the analytic and reproductive. The patient failed, most markedly in language but also in non-language performances, when he had to construct a coherent whole, either in its entirety or on the basis of certain given fragments. The difficulty was not simply in operating with total structures like the disorder in the *Gestalt* function next to be discussed; the patient could understand total structures and he could reproduce them far better than he could produce them in tasks demanding original, creative mental activity. On language intelligence tests the condition appeared in the relatively greater difficulty with the sentence completion test than with the vocabulary or even the controlled association tests. The patient's knowledge of words was extensive and he could evoke them fairly well under simple controlling relationships, but not in the more complicated constructions required in filling out an incomplete sentence so that it would be a coherent whole or in building words from given letters. In non-language performances the difficulty appeared particularly in drawing from memory and in picture and drawing completion tests. The patient could copy something or draw it from a model better than he could construct it himself. In completing drawings or pictures he often had to try several solutions, for he was apparently able to judge their adequacy only when he saw them before him. As in many of the language problems, his critical work was superior to his constructive or creative.[7]

This Case No. 4 is similar to those described as examples of a *Ganzheitsstörung* in that he showed an extensive disorder, the various manifestations of which seemed to originate from a basic change in mental functioning. In his case as in many others, however, the nature of the changes differs from that originally postulated for the *Ganzheitsstörung,* namely, the disorder in the so-called *Gestalt* function. This disorder may appear as a difficulty either in understanding or operating with total structures, or in grasping parts of the structure when the reaction to the whole is fairly normal, or in both. It is extremely broad and may be used to cover a large number of disturbances. In the literature it has been found to be an amazingly apt conception of the disorder in some instances. The fact that it is less prominent in the cases in this research depends partly on the nature of the examinations. Fewer tests in this battery were chosen particularly to bring out disturbances of the part-whole nature. Nevertheless frequent instances of these disturbances appear. There are patients, for example, who are abnormally bound to the parts of the task before them; they get no general conception of the whole. Asked to define a word or to use it in some particular way, they fail because they seize on one of its special meanings and never consider the problem as a whole. Others may understand all the words of a sentence or all the parts of a picture individually and yet fail to grasp the significance of the whole. In the opposite type of case the whole is fairly well appreciated when the parts need not be analyzed or determined separately. Some of these patients were able, as Bouman and Grünbaum noted for their patient, to understand and solve an arithmetic problem when the answer could be immediately given without need for work on the parts of the problem. The two types of disturbance often appear in the same patient, but one type may be more marked than the other. Survey of a number of cases, whether from the literature or from this research, shows many aphasic disturbances which cannot well be represented as of either of these types. In other words, disorder in the so-called *Gestalt* function, like the other concepts described above, accounts for some of the phenomena in aphasia, but does not offer a complete explanation of the nature of the disorders.

---

[7] It is to be noted that this "constructive" disorder is far more extensive than that postulated by Kleist and Strauss in constructive apraxia. It does not involve the simple reproduction of spatial figures but the production of these, and in the more complex language processes where the difficulty is evidently similar in nature, it is clear that the essential disorder is not spatial but constructive.

5. MAJOR CONDITIONS UNDERLYING THE EXTENT AND NATURE OF THE APHASIC DISORDERS

Aphasia as a problem of cerebral functioning will be discussed in Chapter XVIII but certain general statements as to the major anatomical and physiological conditions in the aphasic disorder must be made in this connection. From the anatomical angle it is clear that the extent and nature of the aphasia varies with the site, the extent, and the nature of the pathological lesion but cannot be understood in terms of these alone. While some change in mental functioning probably comes with every cerebral lesion, the presence of aphasia almost always requires a lesion of the dominant hemisphere as indicated by handedness. The variations in type of aphasia according to the site of the lesion or lesions in that hemisphere are not so direct that exact predictions of the characteristics of the aphasic disorder could be made from a knowledge of the site or extent of the lesion or vice versa. In other words, for processes as complex as language and thinking, localization exists simply in the sense that there are certain areas which when damaged are particularly likely to lead to certain forms of deterioration, as a lesion in and around the famous Broca area usually leads to an expressive disorder. The extent of the lesion is by no means the sole determinant of the extent of the disorder. Such is the complexity of cerebral functioning in relation to language and thinking that a slight lesion, particularly if it affects one of many crucial areas, may lead to extensive aphasic disturbances. Far greater lesions may on the contrary invoke less extensive changes, and may sometimes lead to the particular deterioration of amnesic aphasia. Naturally much depends on the nature of the pathology, not only from the point of view of the course of the disorder, but also, as discussed in Chapters XII and XVIII, from the point of view of the initial clinical manifestations.

On the physiological side the problem is the functional activity and organization of the parts of the brain not damaged by the lesion. In general the character of that activity does not change. From the point of view of the aphasia, this situation is revealed in the particular deterioration with marked difficulty in certain performances and less difficulty in others. That is, when one part of the brain is damaged, the functional activity of the remainder does not present a general but a particular deterioration, the characteristics of which depend on the parts which remain and the functional organization of the whole. After the lesion the functional organization of the whole undoubtedly changes. In so far as they are not disturbed by a lesion, the cerebral areas must continue to function in the same way as before, but their importance in the total activity of the individual may be increased or decreased and their part in the organization of the whole changed. Such shifts represent an adaptation to the pathological disturbance, when, for example, an aphasic substitutes one form of expression for another which is badly affected or introduces a round-about method of attaining the end he can no longer reach directly.

To a certain degree the clinical phenomena indicate that the most automatic responses, including Jackson's famous "inferior" speech responses, are the longest retained. As already discussed from the psychological point of view, however, there is no such regularity as to support a general rule that the most automatic and presumably the best-established activities remain functioning longest. Both physiologically and psychologically considered, aphasia is a complex deterioration in which thoroughly established as well as newly organized activities are disturbed.

From the psychological angle the basic conditions to be considered are the nature of the patient's imagery, the level and qualitative characteristics of intelligence in the individual case, and the larger problem of mental functioning as it is best conceived in the light of the aphasic deterioration. Decisive material on the matter of imagery can rarely be obtained because of testing difficulties inherent in the aphasic condition. Nevertheless, the relative prominence of one type of imagery or another must play a part in determining the severity and extent of the disturbance as it appears clinically. When, for example, auditory imagery has been particularly rich and extensive, pathological changes in and around the auditory area must lead to greater disturbances in mental functioning than when visual imagery has been relatively more prominent. Probably of even greater importance is the part played by the so-called verbal imagery before the disorder. There can be no doubt that individuals differ not only in the prominence of auditory, visual, or kinaesthetic imagery, but in the relative importance of these and of the verbal. Were other factors constant, it would be likely that the more prominent the verbal imagery before the disorder, the more severe and extensive the aphasic changes would be. Such general tendencies should be supported by more exact and conclusive data than the cases in this research furnish. An adequate analysis of differences in imagery in relation to the aphasia really requires a knowledge of mental functioning as it existed before the disorder. While clues can sometimes be found in the patient's former occupation or interests, such knowledge would usually require examinations made before as well as after the onset. This condition is certainly not easily met, but with the increasing number of examinations of normal adult individuals, it is at least entering the realm of possibility.

There is much to indicate that many of the particular characteristics of the aphasic disorder and to some degree its extent vary with the level of intelligence. While the type of aphasia is probably little if at all influenced by the intellectual level, particular manifestations of the disorder and the amount of handicap it imposes on the individual are greatly influenced. The more intelligent man clearly differs from the less intelligent in his adaptation to the disorder. When some activity is impossible because of the aphasia, the intelligent patient is better able to develop another method of work to reach approximately the same goal. A simple example is that of the intelligent hospital patient who was asked to count out the linen at a time when he could not count above ten accurately; he solved the problem by laying the linen in piles of ten and adding the piles. Depending on the intelligence of the patient and the nature of the performance, much more complex substitute methods are sometimes developed.

The effect of the intelligence level on the aphasia, however, undoubtedly extends beyond the introduction of substitute methods. Whatever the definition of intelligence, it would be granted that one difference between the more intelligent and the less lies in the complexity of mental functioning. Individuals higher in the scale of intelligence are able to effect solutions to more difficult problems. In so far as these solutions involve a greater degree of logical and verbal formulation than do the solutions of simple problems, they are particularly likely to be seriously affected in the aphasic condition. Thus the man who has been able to handle difficult problems involving complex language formulations experiences a greater loss when these are disturbed than the man whose thinking has never developed to such high levels. The intelligent patient compensates more adequately for his difficulties, but at the same time he probably encounters greater difficulties in the sense of deterioration in a larger proportion of his mental activity.

Differences in the specific nature of the patient's education and training and of his methods of work contribute to differences in mental organization important in determining the characteristics of the aphasic disorder. For example, a patient who customarily articulates as he writes will be likely to show similar disturbances in speaking and writing. When, on the contrary, articulate speech has little part in writing, either form of response may be far more disturbed than the other. Similarly if a patient articulates as he reads, a disturbance in speaking may make reading difficult. If, however, a different type of disorder appears and it is hard for the patient to understand what he reads, he may be materially aided by saying the words aloud.

These specific characteristics or "mental habits" are tangible and relatively easily determined. The larger problem involves a concept of mental organization which will fit the facts of the aphasic disorder. The crucial question is the nature of intellectual functioning, for aphasia is an intellectual as opposed, for example, to an emotional disorder. At the same time it is not a "general defect" in intelligence nor is it a regression to some early stage in racial or individual development.[8] It is a particular deterioration which varies considerably from case to case but is typically most severe in language processes and less severe in non-language performances and social behavior. This situation immediately recalls Thorndike's definition of an abstract, a motor, and a social intelligence.[9] It is a rough distinction, probably based on observed differences in the quality of intelligence in normal persons, but it is so well adapted to the characteristics of the aphasic deterioration that it comes to mind again and again as a most satisfactory working concept.

---

[8] The behavior of the aphasic patient differs from that of the primitive man or of the child at any developmental level both as a whole and in specific responses. Differences in specific responses have been cited in the case records but not discussed generally. Excellent examples are sometimes found in the aphasic's attempt to interpret fairly complex pictures such as those of the Stanford Binet series. When he cannot interpret he does not simply note objects in the picture or describe it as a child does; he may show that he understands the locale or era it is intended to represent when he cannot name the objects or give any description of what is actually present. In some performances his responses are much slower than those of the child or normal adult, but granted extra time he may reach a fairly satisfactory result. Often the extra time is required because of the round-about methods he must introduce when normal methods are disturbed as a result of aphasia. Some of the round-about methods, such as counting on the fingers, are those used by children or poorly trained adults; others are quite different. Analysis of the errors the aphasic patient makes often shows marked differences from the normal. In the first place, they occur less regularly than the normal, sometimes appearing in simple responses when more difficult responses are quite correct. In the second place, they often differ in nature. A larger proportion of them are gross errors. Furthermore, they show less consistency or pattern than the normal. An aphasic may misspell a word three or four times in the same letter, and make a different mistake each time.

Statistical analyses of mental abilities, which have become more and more prominent in recent years, offer several possibilities as to the nature of mental organization, no one of which is as yet established. Spearman and his school maintain the Two-Factor Theory whereby intelligence is conceived in terms of a general factor running through all mental abilities, and of an indefinite number of specific factors each entering into a particular type of ability.[10] The point which most clearly differentiates this theory from the others is the "general" factor, which Spearman finds in all the correlated abilities of any individual and represents psychologically as the eduction of relations and correlates, and physiologically as undifferentiated nervous energy. Kelley and various other authors have denied that a general factor is to be found when suitable groups of subjects are examined. The most satisfactory hypothesis, in Kelley's opinion, is the so-called Group Factor Theory. As the theory is presented by this author, individual differences in mental organization depend on a limited number of group factors, each of which enters into certain performances but not into all.[11] The factors Kelley defined and then tested by statistical means included the verbal, the numerical, the spatial, and the memory. A third group of authors, disagreeing with both of the first two groups, do not accept a general factor running through all mental abilities nor a certain limited number of group factors. They believe that statistical analyses of mental abilities show a large number of independent factors.[12]

In all these theories the statistical approach establishes the degree rather than the nature of the relationship between two performances. The nature of the relationship and the basis for individual variations in mental functioning still remain a matter of definition. No one definition has yet excluded all others, or been well enough established to require that the findings in aphasia be considered under it. The findings themselves, however, are more easily understood under the Group Factor than under either of the other theories.

---

[9] E. L. Thorndike, *Intelligence and its Uses,* Harper's Magazine, 1920, 140, 227–235.

[10] C. Spearman, *The Abilities of Man,* 1927.

[11] T. L. Kelley, *Crossroads in the Mind of Man,* 1928.

[12] See, for example, R. C. Tryon, *Multiple Factors versus Two Factors as Determiners of Abilities,* Psychol. Rev., 1932, 39, 324–351; *So-called Group Factors as Determiners of Abilities, ibid.,* 403–439.

In clear-cut aphasia there is no evidence of a fundamental difficulty in educing relations or correlates or of any other general deterioration which might be expected with a change in the general factor as defined by Spearman. Nor is his physiological concept of this general factor as undifferentiated nervous energy supported by the findings in aphasia, for extensive cerebral lesions which would presumably involve the greatest decrease in this energy often lead to a particular type of change in mental functioning which leaves many performances little if at all affected. Nor can aphasia be understood readily as a change affecting a certain number of specific factors as defined by Spearman, or a certain limited number of a large group of independent factors. It is not a single type of deterioration but it does show regularity within limits. The characteristics of the deterioration indicate that certain groups of abilities are affected far more than others. In many cases the divisions follow along the lines of some of the factors defined by Kelley.[13] The marked disturbances in language, the relative better performances in arithmetic than in other work involving verbal symbols, and the still better non-language performances are conditions which indicate that verbal, numerical, and spatial abilities differ not only in their relative development in normal individuals but also in their relative deterioration in pathological conditions.[14]

---

[13] These cases include those with marked language deterioration and also those like No. 16, reported in Chapter VIII, with a disorder of a spatial nature which is manifested in both language and non-language work. A disorder like that of No. 4 with the greatest difficulty in constructive mental activity does not fit in with the factors in normal mental functioning so far defined. It is of course an easy matter to assume other factors. Indeed assumptions are so easy to make and so difficult to check in this field that one hesitates to carry them very far. It is also easy to fall into the same difficulties with the concept of "factors" as with the old "mental faculties." That which distinguishes the two concepts is not the different abilities defined, but the theories of mental functioning which lie behind them.

[14] It will be noted that little has been said about "memory," one of the factors defined by Kelley. Certain studies of immediate memory were included in the battery of tests and are reported in the case records. A thorough experimental attack on the problem would require many more studies, but the evidence at hand seems to be a satisfactory indication that "memory" cannot be considered a unitary factor in the pathological condition of aphasia. There are great differences according to the material which is to be retained and reproduced. As in other mental processes verbal material is less well handled than non-verbal,

It may well be that these factors are not satisfactory in their definition or that other types of analysis of mental organization will prove better adapted to the facts of both development and deterioration, but it seems clear that differences in verbal and non-verbal thinking will still be recognized. The study of normal adults made as a basis for this research shows differences of this nature. The group is too small for complex statistical analysis, but it is clear, first, that the non-verbal performances show a greater tendency to decline with age than the verbal performances; and second, that the abilities sampled by the verbal tests are more closely interrelated among themselves than they are related to the abilities sampled by the so-called non-language tests. They also appear to be more closely interrelated than are the non-language abilities as a group. The differentiation between the verbal and non-verbal is not easily made; each type probably includes performances which would logically be assigned to the other. It is evident, for example, that the findings for the analogies tests, which are verbal at least so far as material goes, nevertheless show many of the characteristics of the non-language tests results. Whatever the particular lines of division, it seems clear that verbal and non-verbal abilities can be differentiated roughly in the normal as well as in the abnormal groups.

6. SUMMARY

Study of the sixty clear-cut cases of aphasia in this research shows great variations between cases in the extent and nature of the disorder, but regularity in the deterioration in the individual case. Behavior as a whole is fairly orderly; the deterioration assumes a specific character and may persist unchanged for a long period of time. The regularity in the picture does

but even the non-verbal usually shows a deterioration in comparison with the normal. The patient cannot reproduce drawings, for instance, so well as he probably would have been able to before the attack. In almost every case, he shows that he remembers incidents, test problems, and so forth. He also remembers facts and situations of his life experience far better than do cases of general deterioration. From the point of view of memory for words, there are great differences between cases. The amnesic aphasic shows the most severe difficulty, for he is not only unable to evoke a word as a name but when the name has been told him, he is likely to repeat it once and then lose it again immediately. None of the other types of aphasic patient shows such extreme disturbances, but in comparison with the normal they all have difficulty in remembering words. In view of this difficulty it is interesting to find that some patients, even those who are making no noticeable progress, nevertheless do add one or two words to their vocabulary during the course of the examination, and furthermore, that they often treat these words as new and valuable acquisitions, increasing their range of thought.

not mean that aphasia is an absolute loss of certain specific responses. It is not. It is a functional disorder and exhibits a certain variability. The variations may be considered under two groups. The first group includes the daily or monthly variations in response to the same test problem, which may be determined by re-test and which do not, except in cases of acute illness or emotional distress, differ much from normal variability on re-test. The second group includes variations in the quality of the response according to the nature of the situation from which it arises or its own particular character. In these the aphasic does differ from the normal. He can often use phrases in certain familiar or emotional situations which he cannot utter under other conditions, and he can produce automatic word series when he cannot use, or even perhaps repeat, the single words of the series

The aphasic disorder is most marked in the language processes and is sometimes confined almost entirely to these. In most cases, however, without constituting a general deterioration, it extends considerably beyond language. It may affect non-language performances or reactions to the practical problems of daily life or matters of social response or relationship. Furthermore, these fields of behavior may suffer unequally. Variations are great and no general rule can be laid down for aphasia as a whole.

The problem of the relation between language and non-language work is even more clearly a matter for study in the individual case. According to the case and the particular performance involved, the non-language response may seem to suffer as a direct result of the language deterioration, or it may be well preserved either when language is almost entirely lost or when it is so confused as to be incomprehensible.

A study of the essential nature of the aphasic disorder shows individual differences which are so great that no single hypothesis will account for the changes. Nor is it possible, at least at the present time, to specify differences in the nature of the aphasia simply according to differences in the type of disorder or in the pathology. Because it predominates in language processes, there is much to be said for considering aphasia as a symbolic disorder. Not all of the characteristic language disturbances, however, are actually symbolic difficulties, nor will a symbolic disorder account for most of the changes which appear in non-language performances. Attempts to explain aphasia as a disturbance of the less automatic processes, or as a disturbance in constructive mental activity, or as a disorder of the *Gestalt* function are fairly successful in individual cases and in regard to specific types of behavior in many other cases, but they do not hold as single explanations of aphasia.

The anatomical and physiological conditions underlying the nature and extent of the aphasic disorder will be discussed in Chapter XVIII. From the psychological aspect, the basic conditions to be considered are the nature of the patient's imagery, the level of his intelligence, his particular mental habits, and finally the probable nature of mental organization in general. The characteristics of the deterioration in aphasia, with language processes most seriously affected and slighter changes in non-language performances and in social behavior, best fit a concept of intelligence as comprising several more or less independent factors which differ in their relative development in normal individuals and in their relative deterioration in pathological conditions.

XVIII

LOCALIZATION

1. General remarks
2. Localization from the study of cases in this research
3. Cerebral dominance and restitution of function
4. Summary

I. GENERAL REMARKS

APHASIA has probably stimulated the study of cerebral localization more than any other disease process, but at the same time it has served to retard progress. There are a number of causes for this. First of all is the complexity of the subject itself. Even today more than seventy years after the time of Broca, we are almost as far away from the solution of cerebral localization of aphasia. In its infancy with few actual facts it was easy to make a classification of language disorders and to localize them in the cerebral cortex. The competition for new classifications and cerebral areas was so keen that anything in the way of opposition, no matter how soundly based, was swept aside. This is the only way to explain the treatment of Hughlings Jackson's psychological theories which did not gain wide recognition until about fifty years later. It is hard to down ideas of cerebral localization, once accepted, for it is on such fare that most neurologists have been brought up.

Comment has already been made upon the pernicious influence exercised by the acceptance without adequate analysis of many old doctrines. The study of aphasia furnishes an excellent example. About the beginning of this century when many neurologists, such as Marie, were beginning to doubt the validity of the older aphasia doctrines and seeking to find out the actual psychological changes in aphasia, the new doctrines of apraxia and agnosia were advanced. The latter were immediately seized upon and accepted and even today, for many neurologists, furnish an adequate explanation of language and other disorders.

Even in these modern days when the dynamic aspect of aphasia is attracting most attention, old or new classifications are supported or disputed as the case may be with rather scanty evidence. After all, cerebral localization is still largely a matter of theory. We do not as yet know the limits of motor localization. Additional evidence is constantly being presented to show that there is a cortical localization for the extrapyramidal tracts as well as the pyramidal, but this is largely the development of the last few years. There is still a controversy regarding the limits of sensory localization, to say nothing of its subdivisions. As a result of the War experience we know a little bit more of visual localization, but of the limits of auditory representation we know very little.

Real knowledge of localization will not come until we have more accurate data on the course of the afferent fibers from the periphery to their cortical termination and their intracerebral connections, for it is obvious that if definite localization of afferent projection fibers is established, more or less definitely localized association areas in especially close connection with these will probably be ascertained, and this will in turn favor the localization to some extent, at least, of cortical functions. Such localization, in gross at least, of primary afferent projection areas is accepted by the majority of neurologists, but there are important disagreements even here, and there is still more disagreement with respect to more minute localizations within each principal projection area.

An attack on the problem from this standpoint has recently been made by Stephen Poliak who studied the main afferent fiber systems of the cerebral cortex in primates.[1] With regard to the auditory region there is uncertainty as to whether the primary projectional auditory cortex is a small well-defined area or whether it extends over a considerable portion of the temporal cortex. According to Poliak's investigations the cortical area supplied by the auditory radiation is the upper half of the superior temporal convolution and only that. Only a few fibers reach the free surface of the temporal lobe. The most richly supplied portion is a small zone in the posterior corner of the Sylvian fossa where there is an elevation comparable with the transverse temporal convolution of Heschl in man. This zone represents the nuclear or focal zone of the auditory cortex. The author concludes from the spatial arrangement of the cochlear fibers that there is a spatially arranged system for the conduction of various tones, and has made an interesting attempt to explain the minute function of the auditory system, based on the arrangement of the direct and spiral cochlear nerve fibers. The complicated problems and contradictory views arising in regard to aphasia are concerned in the solution of this question, and yet what is quoted above is as much as is known well enough about the cortical aspects of auditory sensation. When one considers the various types of auditory aphasia that have been built on more slender grounds, it can be readily realized that the evidence upon which cortical localization of aphasia can be based is small indeed.

---

[1] S. Poliak, *The Main Afferent Fiber Systems of the Cerebral Cortex in Primates,* 1932.

Generally speaking neurologists are divided into two groups regarding the question of cortical localization: the "localists" who adhere to the view of circumscribed limited areas of spatial representation, and those who believe in more diffuse projection without definite spatial localization, that is, in an equipotentiality of all parts of the cortex or something approaching it. The latter view is apparently more favorable to the requirements of the *Gestalt* School of psychology, which, however, undoubtedly admits of some localization. Whatever the view held it seems obvious that mental functioning is the result of the activity of the entire brain, and that in this complicated structure, the association fibers play the chief role in coordinating activity. It is folly to attempt to subdivide the various functions into parts, such as mental faculties, for none such exist. There is no doubt that there is localization in the sense that motion, sensation, vision, hearing, smell, and taste have a more definite localization in the brain structure, and that because of heredity and usage certain parts of the brain may be better developed, but that does not mean that mental functioning such as is necessary in the understanding and expression of speech must be confined to the auditory or motor cortex; in the language process it is necessary for the entire brain to act in a unified manner.

In dealing with the question of localization of speech function two aspects of the problem are presented by any lesion which interferes with normal speech: one, the negative phase, that is, what the patient is unable to do because of the lesion, and two, the positive phase or what he is able to do; the latter appears in the speech and the behavior which remain, and is the result of the activity of the undamaged brain. The first or negative aspect has received most consideration and it is upon the pathological evidence that most attention has been placed.

Consideration of the problem, however, shows at once that the dynamic phase, or what the patient is able to do, is of greater importance. It is obvious that the undamaged structures must readjust themselves to new or unaccustomed physiological activity, and in addition call upon available new structures, such as the right brain, to help out in the language process. It must here be emphasized that in contrast to the negative or pathological aspect, we are dealing with a dynamic or live physiological activity which it is impossible to measure or define. All we know is that it cannot produce normal language, but that what it does produce is the result of the activity of the uninjured brain.

Whether the physiological activity demanded of damaged structures takes more or less energy, as discussed by Goldstein, is not important. The point is that in normal or damaged structures physiological activities are dependent upon the functioning of the anatomical parts. It is so with language. In diseased processes such as are found in aphasia, it is possible only to produce what undamaged structures are capable of producing.

2. LOCALIZATION FROM THE STUDY OF CASES IN THIS RESEARCH

So far as this research is concerned, little of a positive character has been contributed to the problem of localization. The negative evidence, however, is of importance. From the positive standpoint we have been able to obtain only three necropsies, all of them in tumor cases. In addition in 11 cases by operation some idea has been ascertained as to the extent of the lesion. The information gained from the 8 traumatic cases is perhaps on a par with the tumors, that is, not reliable. This leaves the 37 vascular cases, with no necropsy and in which the locale of the lesion is dependent on the clinical organic symptoms. Admittedly such motor, sensory, and visual symptomatology is poor material from which localization can be judged with any degree of accuracy, but it becomes even less reliable when it is considered that in most cases because of the presence of aphasia, the sensory, visual, and special phenomena are difficult to determine.

For what it is worth, an analysis of the case material shows the following points.[2] The *tumor* cases have been discussed in Chapter XII. In 10 of the 15 cases, the aphasia was of value in indicating the side of the brain in which the lesion was located and in 3 patients, the aphasic symptoms, in the absence of others, were of primary value. The other clinical evidence can be disregarded. In the 3 necropsied cases, the pathological evidence is inconclusive. In all the lesion was very extensive, the tumor occupying the frontal, parietal, and temporal lobes. In two the type of neoplasm was the same, a spongioblastoma, and in one a calcified astrocytoma. Yet the type of aphasia differed in all, being respectively expressive, expressive-receptive, and amnesic. The extent of the lesion in the operative cases was even less reliable, for in practically all the tumor cases, especially those invading the cortex and subcortex, the lesion was extensive and larger in area than indicated by operation.

---

[2] Most of the cases are given in detail either in Appendix I or in the text, in the discussions of types of aphasia and the chapter on brain tumors.

It would be presumptive to base any conclusions on the 8 *traumatic* cases. The majority of the material used by such modern investigators as Head, Goldstein, and Kleist, during and following the World War, was of such character. In the last few years, because of the increased knowledge gained by new histological methods, particularly by the newer staining of glial tissue, evidence has accumulated to show that traumatic brain injuries, especially those which are followed by concussion and aphasic symptoms, result in many scattered lesions of diffuse character. It would seem that an attempt at localization from such material would be anything but accurate.

Of the 8 traumatic cases in our series 7 were operated upon. In 3 there was trauma of the central parieto-temporal area, and in 3 subdural hemorrhage. Case 35 (Appendix I) illustrates best the unreliability of traumatic material. This patient, a college graduate, as a result of an automobile accident, had a depression of the left skull about as large as the top of the index finger in what would be regarded as directly over Broca's area. At the operation the surgeon, Dr. Grant, removed the spicule of bone and found "the most perfectly localized scar in what I take to be Broca's area. The scar was 1½ cm. across in either diameter and seemed to be strictly localized to the cortex. On palpation it seemed to be so superficial, scarcely more than 2 mm. deep, that excision seemed inadvisable." And yet the type of aphasia was not predominantly expressive.

The remaining cases, 37, were *vascular* in origin. Of the 18 expressive cases, the history and symptoms indicated that 10 were probably thrombotic and 5 embolic in the distribution of the middle cerebral artery. In two there were probably cortical hemorrhages, and in one a subarachnoid hemorrhage. In the 11 receptive cases, 8 probably had a thrombosis of the middle cerebral artery, one hemorrhage in its distribution, and 2 hemorrhage in the cortical parts. Of the 8 expressive-receptive cases there was probably thrombosis of the middle cerebral artery in 7 cases, and hemorrhage in one. In summary, of the 37 vascular cases, the clinical symptoms indicated thrombosis of the middle cerebral artery in whole or in part in 25, embolism in 5, hemorrhage in the distribution of the middle cerebral artery in 2, subarachnoid hemorrhage in one, and cortical hemorrhage in 4.

From the *clinical symptomatology,* of the 18 *expressive* cases there was frank hemiplegia in 14, involvement only of the face and arm and very little of the leg in 2, and implication of the lower face only in the remaining 2. In practically all, the face and arm were proportionately more paretic than the leg. In only 2 were there any sensory symptoms; these were practically identical and consisted of disturbance in the entire hemiplegic side of mild character, with astereognosis. Visual symptoms occurred in the same 2 patients, consisting in one of a beginning hemianopsia, and in the other, of contraction of the visual field. It would seem, therefore, that in the expressive cases from the clinical standpoint, in the great majority, the lesion is preponderantly in the motor or anterior part of the brain, with less implication of the posterior part.

In the 11 *receptive* cases it was noticeable that the hemiparesis which occurred in 9 was not only less marked than in the expressive group, but in 5 the motor symptoms either improved or cleared up rapidly. In 2 there was implication of the lower face only. Sensory symptoms of a mild character associated with hemianopsia occurred in 2 patients. It would seem therefore that in the receptive cases the anterior or motor part of the brain is predominantly implicated but less severely than in the expressive group, and that the posterior part of the brain, while considerably less involved than the anterior, is more likely to be diseased than in the expressive cases.

The *expressive-receptive* cases were more distinctive in that in all the hemiplegia was more marked, and there was little or no improvement in the course of the paresis. It was impossible because of the aphasia to determine accurately the presence of sensory or visual disturbances.

In evaluating the symptomatology of the above group of vascular cases it is important to emphasize that only the motor, sensory, and visual phenomena were considered, and that of these the motor alone were reliable. It is striking that in every instance the central or lower portion of the face was implicated. In some there was in addition paresis of the tongue.

During the study of this material an effort was made to delimit the lesion more accurately, that is, to localize cortical from subcortical or combined involvement, but such an attempt was fruitless.

There is a striking parallel between the extent and behavior of the lesion and the course of the disorder, the subject of Chapter XV. Here 36 selected cases are discussed from the standpoint of stability of symptoms, improvement, and deterioration. The course of the disorder neurologically and psychologically is compared. The group showing most improvement belongs largely to the expressive and less to the receptive, as would be expected. As to the stable group, of the 7 who were studied during a median of 18 months, 6 belonged to the expressive-receptive and one to the expressive type. During the entire period there was no improvement neurologically or psychologically. If inferences are permissible, the improvement in the expressive group is because the lesion is largely in the anterior or motor part of the brain; in the receptive, while still largely in the anterior part, there is a greater implication of the posterior portion; in the expressive-receptive group, both the extent and severity of the lesion are most marked.

In the *amnesic* cases, as already emphasized, in spite of the fact that they formed the most distinctive type of aphasia, with the one fundamental difficulty of evoking words as names, the lesion in 4 of the 5 cases consisted of a benign, slowly growing glioma; the involvement in each case was quite extensive, with a varying number of intact axis cylinders capable of functioning in the infiltrating areas. One case, No. 7, fully described in Chapter XI, was carefully studied for two years before operation and following this until death. A large calcified astrocytoma, invading most of the left hemisphere, gave little precise evidence of localization.

One amnesic case, No. 47 (Appendix I) did furnish some evidence of focal involvement. A boy of 12, with a history of running ear on the left side of long duration, two weeks before observation gradually developed drowsiness, photophobia, mental confusion, and difficulty in speaking. Examination showed slight weakness of the right side of the face, with hyperactive reflexes on this side, slow pulse, slight leucocytosis, and normal fundi with slight concentric contraction of the visual fields. In the first part of the two-stage operation in which the left mastoid was opened in the usual manner, a discharging sinus leading for 2 inches into the left temporal lobe was exposed. Pus drained for 2 to 3 days. Almost immediately the aphasic symptoms lessened, and within a week disappeared.

Another attack on the problem of localization was made by selecting those cases in which psychological examination indicated a preponderant involvement of one language process. These are the cases which in the localization era would have been labeled as cases of anomia, alexia, agraphia, and so forth. They consisted among others of the 5 amnesic cases, 2 cases of preponderant involvement in speaking, 2 in reading, one in writing and arithmetic, and one in writing to dictation. If necropsy material later becomes available, it may be possible to determine why these patients showed a relatively clearer involvement of one language process than did the others of the group. No differentiations can be made on the basis of the clinical findings. Furthermore, in some cases it seems evident that individual characteristics of education and experience are sufficient to explain why there was a preponderant involvement of one language process in a particular case when more extensive disturbances occurred in most of the other cases.

Analysis of those cases in which there was a similarity in the psychological results failed to give any definite indication of localization. This was also true of those cases in which there was a marked differentiation in the results of the language and non-language tests. The latter, as has been discussed more fully in Chapter XVII, while dependent in part on verbal formulations, that is on language, must depend on the normal functioning of both sides of the brain. Obviously, filling in formboards and similar acts are performed by either or both hands and are dependent on motor, kinaesthetic, and visual activities of both hemispheres.

3. CEREBRAL DOMINANCE AND RESTITUTION OF FUNCTION

On the question of localization in the right or left hemisphere, the study presents material from both aphasic and control groups. Analysis of the 98 cases of unilateral cerebral lesion, as presented in Table XIX (page 452), shows:

1. Aphasia or a history of speech difficulty at the time of the attack in 65 of the 67 right-handed patients with demonstrated lesions of the left hemisphere or neurological signs of such lesions.
2. Aphasia in 2 left-handed patients, one with a lesion in the right hemisphere and one with a lesion in the left.
3. No aphasia or history of it in 22 of the 23 right-handed patients with lesions of the right hemisphere or neurological signs of such lesions.
4. Aphasia in 3 of the 5 ambidextrous patients with a lesion in the left hemisphere, and in the one ambidextrous patient with neurological signs of a lesion in the right hemisphere.

Thus among the 92 clearly right-handed or clearly left-handed patients there are only 4 exceptions to the rule that aphasia appears with lesion of the dominant hemisphere as indicated by handedness, and fails to appear with lesion of the non-dominant hemisphere. In other words, the dominance indicated by handedness is a criterion of the crucial hemisphere for speech in about 95 per cent of the cases.

TABLE XIX

RELATION OF HANDEDNESS TO LOCATION OF BRAIN LESION IN NINETY-EIGHT CASES

PATIENT		LEFT HEMISPHERE		RIGHT HEMISPHERE	
Type	*Handedness*	*Demonstrated lesion*	*Lesion indicated by neurological signs*	*Demonstrated lesion*	*Lesion indicated by neurological signs*
Aphasic	R	17	36		1
	R–L	2	1		1
	L	1		1	
Non-aphasic with history of speech difficulty at time of attack	R	2	10		
	R–L				
	L				
Non-aphasic without history of speech difficulty	R		2	3	19
	R–L		2		
	L				
Total		*22*	*51*	*4*	*21*

The determination of the part played in language by the less dominant hemisphere is of the utmost importance. The pertinent literature has been covered in Chapters III and IV. Most investigators, without any direct evidence and for want of a satisfactory explanation for the retention, return, or lessening of symptoms following lesions have assigned language roles to the uninvolved hemisphere. In coming to a conclusion we have tried to sift the chaff from the wheat. The only direct evidence, and yet of the utmost importance, is the study of cases of unilateral cerebral lesion without aphasia. In a series of 22 cases of right-sided cerebral lesions with no aphasia, comparable studies with normals, matched normals, and aphasics show that there is a distinct mental deterioration, which is not at all like that found in aphasics. The important point is, however, that such mental deterioration exists. While this series of cases is not large enough to warrant definite conclusions, the results are so uniform as to leave no doubt that the right brain is concerned in mental functioning.[3]

It would seem as if the right brain, while not directly concerned in language in the right-handed individual, nevertheless is in a state of receptivity for language acquisition, the degree varying in accordance with the use of the left hand in writing. In addition, non-language functions and behavior, which are almost always implicated in aphasia, have admittedly a bilateral cerebral basis. This is as far as we can go from the evidence obtained in this research. There is nothing to show that the right brain has any specific language function as indicated by Jackson and some more recent investigators.

4. SUMMARY

From the aphasic case material it is evident that a unilateral cerebral lesion in the dominant hemisphere can alone produce disturbances of language without any implication of the other cerebral hemisphere. The cases of right-sided cerebral lesion without aphasia show certain changes in mental functioning, but these are not comparable with those characterizing aphasic disorders. The non-dominant hemisphere is apparently concerned with normal language function, but to a limited degree.

Study of the localization of the lesions in relation to the four clinical types of aphasia shows that in the predominantly expressive group the lesion is largely in the anterior or motor part of the brain. In the receptive group, while the lesion is still largely in the anterior part of the brain, it is less severe, and the posterior part of the brain, that is, the sensory portion, is more implicated than in the expressive group. In the expressive-receptive type there is larger and more permanent involvement of both anterior and posterior parts of the brain, the anterior probably more than the posterior. Nothing definite can be stated regarding localization in the amnesic group, except in one case in which the lesion seemed to be in the temporal lobe. It is well to point out, however, that in the other four cases, including a case with necropsy, the indications were that the tumor in each instance was large and involved the anterior and posterior parts of the brain as well as the temporal.

---

[3] This subject has been dealt with fully in Chapter XIII.

No more decisive evidence on the question of localization was obtained from study of those cases in which the psychological changes were relatively specific. It must be noted that even in these cases the disturbances were never confined to one language process, and that their more or less extensive character suggests diffuse pathological changes within certain limited areas outlined above. Furthermore, the psychological studies in the aphasic cases, the cases of unilateral cerebral lesion without aphasia, and the normal adults indicate that the language function is subserved by the unified activity of the entire brain.

Every lesion which causes aphasia produces a negative and a positive aspect. The negative is the result of the lesion and is responsible for what the patient cannot do. The positive, or what language and behavior the patient is capable of, is the result of the functioning of the uninjured brain. Such physiological activity is a live dynamic process and cannot be measured. That is why localization of language and its disturbances is impossible.

XIX

CONCEPTS OF APHASIA, APRAXIA, AND AGNOSIA: A COMPARISON WITH CURRENT VIEWS

1. The study of aphasia
2. The nature of aphasia
3. The classification of aphasic disorders
4. Apraxia and agnosia
5. Localization of lesions in aphasia

1. THE STUDY OF APHASIA

THE three main points of difference between the study of aphasia as it was carried through in this research and in other investigations are: first, the controlled study with the work of aphasic patients interpreted in the light of examinations of normal adults comparable to the aphasic patients in age and in educational and occupational classes, and contrasted with the work of control cases of unilateral cerebral lesion without aphasia; second, the limitation of the aphasic group to clear-cut cases uncomplicated by any other disorder known to affect mental functioning; and third, the extensive studies of language and non-language performances in a large group of aphasic patients. Extensive studies of normal adults have never been made as a basis for research in aphasia. The usual practice has been to judge the aphasic disturbances from what was known of the patient's education and occupation before the disorder, from the results of various isolated studies of normal adult behavior or from special studies made in connection with the aphasia research and usually based on tests of a few orderlies or other hospital employees. The first system, the judgment according to the patient's former status, has been fairly satisfactory when that status was known to be high, but extremely uncertain for the great group of "average" individuals. The second system has fallen down because there have not been complete enough studies of normal adults to establish the range and characteristics of adult responses in all the activities which may be disturbed in aphasia. These facts must be established on the basis of a fairly large group of persons representing a random sample of the population. The choice of orderlies and other attendants to demonstrate normal adult behavior is unjustified because these groups undoubtedly fall below the average of the population at large. Furthermore, as members of one particular semi-skilled occupation, they give little indication of qualitative differences in ability such as appear, for example, in the skilled mechanic.

The importance of a knowledge of normal behavior is now widely recognized even though the necessary studies have not previously been made. There are still investigators, however, who contend that such studies are not necessary because the aphasic disturbances appear in performances where the normal person, except in rare instances of fatigue or excitement, experiences no difficulty whatsoever. They claim that the more complex performances are tests of intelligence which should not be included in examinations for aphasia. This view contains a false representation of the nature of aphasia. It is indeed a disorder which affects the simplest speech responses on which the normal person rarely fails, responses such as articulating and forming words, producing normal sentence constructions, evoking familiar words as names, and understanding ordinary conversation. But it extends to the most complex processes of language and behavior, in which normal adults vary greatly in quality of responses, and in these complex processes the extent and nature of the aphasia cannot be determined without a knowledge of the performances of normal adults comparable to the aphasic patients in age and in educational and occupational status.

It is the fact that the aphasic disorder is so complex and sometimes extends so far beyond the simpler speech difficulties which makes it particularly important that studies of the disorder should be based on clear-cut cases. The aphasic patients in this research were not only limited to those uncomplicated by other disorders known to affect mental functioning, but were accepted for the group only if they were under sixty years of age. The cases of the literature have all too frequently been patients of seventy or eighty years with obvious senile changes in addition to the aphasic disturbances. When senile or other mental changes are present, it may still be possible to differentiate the specific speech disturbances of the aphasia, but it is impossible to determine the extent and nature of the aphasic disorder among the complex changes in mental functioning.

The examinations of the aphasic patients in this research have these characteristics: they are adapted to disclose the extent and nature of the disorder, for they include studies of complex performances in both language and non-language fields as well as tests of simple speech responses; they are thorough enough to reveal slight as well as severe disturbances; and they represent comparable studies of a relatively large group of cases. When Henschen made his tremendous survey of the literature in 1920, in spite of the fact that he omitted many cases because of incomplete clinical or pathological data, he included a very large number where the examinations of the speech disturbances would now be considered inadequate. Since 1920 well-studied cases have been increasingly frequent, but the results of our survey indicate that many reports still fall short either because they are based on studies of too limited a field of language and behavior or because they estimate the severity of the disturbances from one or two responses only.

Goldstein and his colleagues have placed the emphasis not on the survey of a number of cases but on the complete study of an individual case. In so far as a case studied incompletely has little or no value, their view is altogether justified. So great, however, are individual variations in the disturbances commonly included under the term "aphasia," that no single case can be taken to demonstrate the extent and nature of the disorder as a whole. Furthermore, when tests and examination methods differ greatly it is hard to pool the results of many isolated case studies and come to conclusions about the characteristics of the disorder in general. For these reasons a planned study of a long series of cases has the advantage over a group of isolated investigations. Nevertheless the isolated studies have a particular contribution to make and because of it always assume an important place; they represent different theoretical approaches and consequently different methods of examination. Thus, while a standard examination of many patients must form the basis for a complete study of aphasia, it must often be modified or supplemented when the results of some particular investigation lead to a new hypothesis which must be tried out by new methods of testing.

As to the particular tests and examination methods, those used in this research were drawn largely from the psychological and educational achievement tests now in common use. Many of these had to be modified, and they had to be supplemented by tests for the specific speech difficulties. The German investigators have also employed the current psychological tests, and as a whole the battery arranged here is more closely akin to those used in Germany than to any others. It differs from the German systems, in so far as these can be judged by the case reports in the literature: first, in that it includes a more complete study of non-language performances; second, in that it represents a more thorough examination with a greater number of test items of any given performance; and third, a related point, in that the larger number of test items present many gradations of difficulty and so make for a better judgment as to the degree of disorder.

In the beginning a complete set of Head's serial tests was given to each aphasic patient. The systematic studies of object- and color-naming proved to be excellent and their use was continued. The Hand, Ear, and Eye Test was found to be valuable in cases where there was a certain difficulty in comprehension or in spatial orientation. The other tests of the battery, however, were discontinued during the second year of the work because, for the time they consumed, they gave far less insight into the processes which might be disturbed in aphasia than did the tests borrowed from the field of psychological and educational examination. It seemed clear that Head's battery as a whole was a logical construction, designed to reveal symbolic disturbances, but not suited to analyze many of the phenomena of aphasia, to study the more complex language or non-language performances or to reveal all degrees of disturbance in any performance.

2. THE NATURE OF APHASIA

The results of this research demonstrate that aphasia is predominately a language disorder, but they are equally conclusive proof that it is rarely if ever confined to language processes. It extends to the activities required by the so-called non-language tests, and sometimes to reactions to practical situations of daily life and to social responses and attitudes. These results are in accord with those presented by Head, Van Woerkom, Goldstein, Lange, Klein, and the many other investigators who find that they cannot limit aphasia to a disorder of language.

When the comparison between the findings of this research and the views of the current literature is carried further, certain major disagreements arise. The results do not support Head's view of the nature of the disorder and the relationship between the disturbances in verbal and overtly non-verbal responses. Aphasia is not simply a symbolic disorder, as Head defined it, nor are many of the disturbances in non-verbal responses dependent, as he suggested, on faulty verbal formulation. The concept of aphasia must be broad enough to cover not only various types of change in language processes, some of which are not symbolic disturbances, but also changes in mental functioning which are independent of the language difficulties.

A second major disagreement has to do with the concept of aphasia as a *Ganzheitsstörung,* manifested in all forms of behavior. As a group the sixty aphasic patients gave no evidence of a fundamental disorder which could be taken as a universal basis for the aphasic phenomena. Analysis of the individual cases showed diversity in the essential nature of the disorder as well as in its manifestations. A certain number but not all of the cases presented facts similar to those which have led to the assumption of a *Ganzheitsstörung* in the literature; that is, in different types of performances they showed changes which were obviously related. Such a relationship is clear in the amnesic disorder where the patient fails in speaking, reading, writing, and so forth because of the central amnesic difficulty in evoking the word as a name. A relationship of another kind is apparent in those cases where a particular type of thought activity seems difficult in any field, language or non-language; for example, where the patient fails in all performances requiring "spatial thinking." In cases of this kind the disorder is truly "fundamental" in the sense that it affects many specific performances. It is not general, however, for it does not affect all behavior; and it is not a change which characterizes aphasia as a whole.

Experience with the sixty clear-cut aphasic cases of this group does not support Goldstein's opinion as to the changes in the total personality in aphasia. It is undoubtedly true that the aphasic disorder, like any other major illness, requires a new adjustment of the personality. Close and prolonged observation of these patients, however, indicates that the type of readjustment varies according to the circumstances and the characteristics of the individual, and furthermore that the typical aphasic patient shows comparatively slight changes in his social reactions and in his personality. The insignificance of these changes in contrast to the marked disturbances in language differentiates the clear-cut aphasic patient very decidedly from the patients with general mental confusion or deterioration.

The case studies make it clear that neither the amnesic aphasia nor any other type is well considered as a regression to a more primitive level of thinking such as Goldstein postulates. The aphasic patient is not more primitive in his behavior as a whole nor in many of his specific responses. He shows a complex deterioration which is not comparable to any stage in the development of the race or of the individual. His greatest losses are in language processes but these do not leave him reacting in non-verbal situations as he would have reacted before language developed.[1] When his language is seriously damaged, he may still show complicated social attitudes and achieve certain complex non-verbal performances which indicate a high type of mental functioning. In many types of case, including the amnesic, a remarkable retention of concepts is apparent in spite of inadequate or confused language responses.

As to the deterioration in language itself, there can be no question about the accuracy of the facts which Jackson cited to show the nature of the dissolution in aphasia, with the preservation of the "highly organized" emotional or automatic responses. It has been demonstrated again and again that under certain conditions, the aphasic patient may swear or produce some automatic phrase when he cannot utter these or any other words under ordinary conditions. But an understanding of the nature of the deterioration in aphasia cannot rest on these facts alone, however striking they may be. All the other aphasic phenomena must be considered as well and when they are, it is evident that the deterioration does not involve a regular regression but various complex breakdowns in which long- and well-established responses are sometimes disturbed earlier or more severely than those which are presumably less stable. The preservation of automatic and emotional speech responses is frequent enough to be cited as a general rule, but there is no general rule as to the characteristics of the aphasic deterioration as a whole. The greatest difficulties are sometimes in the most complex processes of language and thinking and sometimes in the simplest of speech habits.

The old question of the extent to which aphasia involves a "defect of intelligence" is of course an integral part of the whole discussion of the nature of aphasia. When aphasia is studied not only for the language disorder but for all the characteristics of mental functioning, the changes in intelligence become a fundamental problem. In much of the literature on aphasia, however, particularly in the early days, the problem was rather a side issue and received a separate discussion. Consequently even though the pertinent facts have already been discussed, it is well to make a summary statement on the question of aphasia as a defect of intelligence.

---

[1] It is to be noted that Goldstein points out the difference between the reactions of the aphasic when he has difficulty using words as names and the reactions of the child who has not come to use them categorically. Nevertheless he maintains that a regression to a more primitive type of thought and behavior occurs in aphasia.

The extensive examinations in this research, with non-language as well as language tests, are adapted to bring out the important facts. Much naturally depends on the definition of intelligence, but it is clear that aphasia does not involve a "general intellectual defect" such as Marie postulated in addition to a special defect of language. As the majority of authors since Broca have maintained, the clear-cut aphasic patient does not show a general diminution in intelligence. His intelligence suffers in particular ways, and the value of a well-rounded psychological examination is that it shows what these particular ways are. In general it is true as the majority of investigators have said that intelligence suffers in so far as language is lost or disturbed, but this statement is not at all adequate. It covers the fact that difficulty in expression or understanding, or loss or confusion in verbal symbols necessarily means a deterioration in intelligence, for language responses and thinking in verbal terms are components and often essential components of intelligent performances. It falls short, however, because it takes no account either of the different kinds of change in language processes which the aphasia may bring or of the changes in non-verbal processes which cannot be traced to the language disorder. With regard to the former, it must be noted that when the language difficulty predominates in the simpler speech mechanisms, as in some forms of expressive disorder, the change in intelligence is at a minimum. When the language difficulty concerns the more complex processes in a serious way, however, there is a marked change in intelligence. Even in such cases the severity of the language disorder is no regular indication of the severity of the disturbance in intelligence. The lack of a regular relation depends in part on the somewhat different role which language plays in different individuals. It cannot be doubted that verbal symbols and language formulations have permeated mental functioning to a far greater extent in some persons than in others, and that the more firmly established they are as types of reactions and means of attacking problems the greater will be the consequences of the language disorder.

The different part which language plays in mental functioning, however, is not the only factor making for an irregular relation between the severity of the aphasia and the severity of the deterioration in intelligence. A second and most important factor is the change which may be a part of the aphasia in the broad sense in which that term must be used, but is not directly dependent on the language disorder. Marie was wrong in maintaining that aphasia was in any way a general defect of intelligence, but right in his belief that other types of mental functioning beyond the language might be affected. The particular nature of the changes in non-language processes has been demonstrated since Marie's work in case studies made by Head, Goldstein, Van Woerkom, Bouman and Grünbaum, Lange, Klein, and many others, and is clear from the analyses of many of the cases of this research. There is ample evidence now that aphasia is a particular deterioration, not a general defect of intelligence. The extent to which intelligence may be said to be affected varies from case to case; but for aphasic patients as a group it is evident, first, that intelligence suffers in so far as the language processes disturbed are necessary to the carrying out of intelligent behavior and, second, in so far as non-verbal activities are handicapped by changes in mental functioning which extend beyond language processes and are not dependent upon them. The further definition of the changes in intelligence in aphasia must be determined in the individual case, with due regard not only for the decreased efficiency but for the particular qualitative characteristics of the changes.

3. THE CLASSIFICATION OF APHASIC DISORDERS

The classification adopted in this research was demanded by the actual changes found in language processes. When the cases were analyzed and differentiated according to the characteristics of the language responses, four main groups were required. The names to be assigned to these groups are, as Head pointed out, a minor problem; they should in so far as possible be descriptive of the particular types of disorder. The names chosen—expressive, receptive, expressive-receptive, and amnesic—are already well established in the literature and are on the whole extremely satisfactory.

The principle underlying this classification, that the groups should be set up according to the clinical findings, is in accord with Head's views on the subject. Study of Head's work, however, throws some doubt on his adherence to these views. His four types of disorder are admittedly partial affections of "symbolic formulation and expression." The latter, which Head thought "an empirical group of functions more or less necessary for the proper use of language," is certainly an assumption when taken to represent the processes affected in aphasia. The four types of disorder seem to rest on a logical analysis of this symbolic process as much as on a determination of the actual changes in language and behavior. Whatever the names, however, the four types do not represent a classification which could be used for the patients in our group. The only one of the four which corresponds to a form of disorder appearing among these cases is the verbal. It is practically the same as the expressive disorder or the usual concept of a complex motor aphasia.

The differentiation of types of aphasia according to the various forms of language—speaking, understanding, reading, and writing—is, as Head pointed out, an arbitrary and unsatisfactory procedure, for actual studies do not show that one of these forms is affected to the exclusion of others, or even that the typical case manifests a predominant disturbance in one of these forms. The fact that no "pure" forms of disorder—pure motor aphasia, word-deafness, agraphia, or alexia—appeared among the patients of this research is in itself a weighty argument against the existence of such forms, for the five-year survey covered a good cross-section of the average run of aphasic patients. More than that, it was based on thorough examinations which would have been sufficient to reveal a pure disorder if such a phenomenon had existed. In all probability it is the thoroughness of the examinations which showed each disorder in its actual complexity. Head's experience led him also to conclude that "pure" forms of aphasia did not exist, and he took his stand not only on the basis of his clinical findings, but also on the fact that language functioning was too complex for one part of the process to be disturbed in isolation. Apparently neither the clinical findings nor the realization of the complexity of the language process has been enough to carry his argument; the general reaction has been that pure cases are to be found in the literature, even if rarely, and must therefore be admitted. In short, the belief in "pure" disorders cannot be undermined so long as illustrative cases are thought to have appeared in the literature. Consequently a survey of most of these cases was made in order to determine whether they actually presented "pure" disorders. A true understanding of most of the early cases is difficult, first, because the reports are so incomplete; second, because there is an obvious tendency to force the cases into the moulds which had been constructed theoretically, sometimes before any case in point had been described; and, third, because the term "pure" has had different meanings in different connections. For example, a pure motor aphasia has sometimes been differentiated simply on the basis of an inability to speak words and phrases which the patient could still write. In other words, a "pure" disorder has not always meant a disturbance in one form of language uncomplicated by any other changes. It has been said to be pure on the basis of some particular criterion such as "intact writing" or "intact inner speech," or because one of the disturbances present seemed to be functionally independent of the others. Naturally the particular usages of the term "pure" have increased the number of so-called pure cases in the literature. Whatever the use of the term, however, survey of many cases gave no indication that there were isolated forms of disorder consisting simply of a difficulty in articulating and forming words, in appreciating speech sounds or in understanding words and sentences, in reading or in writing. Whenever reports were sufficiently complete it was evident that the disorder, like some of those studied in this research, undoubtedly affected one form of language more than any other; nevertheless it always extended beyond this form and represented a fairly complex change.[2]

While the results of this study are in direct opposition to the classical doctrine of pure forms of aphasia, on the question of classification as a whole they are in much closer agreement with that doctrine than with any of the attempts which have been made to undermine it. The expressive, receptive, expressive-receptive, and amnesic types of disorder are the same as the main forms outlined by Pick. The expressive and receptive types are in essentials the classical cortical motor and cortical sensory aphasia. New test methods have brought out new facts which make for great differences in the understanding of the nature and extent of these disorders, but they confirm the main points of the descriptions of aphemia or motor aphasia as given by Broca and of sensory aphasia as given by Wernicke. The case studies give no support for Marie's opposition to the classical doctrine on the ground that aphasia is a unitary disorder, appearing in its clearest form in Wernicke's aphasia, and combined with anarthria in Broca's aphasia.

---

[2] When pure forms of disorder are not found, there is no question, as Head noted, of grouping the aphasias with the apraxias and agnosias. Even in cases where the simpler speech defects predominate, they are accompanied by more complicated disturbances in language and thinking which cannot be understood as apraxic or agnosic.

They show no reason why Head should have accepted only the expressive or cortical motor aphasia, and rejected the receptive or cortical sensory.

It is true, however, that the receptive disorders are more complex and less well described by the term "receptive" than are the expressive by the term "expressive." The latter are clearly language disorders which involve far more than verbal formulation and expression, but still predominate in expressive processes as compared with receptive. The receptive disorders, however, involve not only difficulty in the understanding of spoken language or printed material but disturbances in speaking and writing which may be marked. The fact that the expressive disturbances are sometimes more prominent than the receptive has led many investigators to reject the term "receptive." The nature of the receptive aphasias in this group of cases justified the preservation of the term. The disorders differed considerably but all presented decided difficulty in understanding spoken language or printed material or both, together with more or less severe changes in speaking and writing.[3] These changes were characterized not only by word misformations, but by verbal and grammatical confusions. In the usual terminology, there were paraphasias and paragrammatisms. The relative severity of these changes and of the receptive difficulties in any case is less important than the fact that these particular expressive changes appear with the difficulties in understanding.

The severe form of aphasia in which both expressive and receptive processes are much affected is not a subject of controversy either from the classical or the modern point of view. The interesting new facts which these studies revealed were the result of extensive use of non-language tests with such patients. Except as it was indicated by general observation of the patient's behavior, the high level of functioning in non-language work which may continue when language is extremely limited is a condition which has not been brought out in the literature.

The question of amnesic aphasia on the contrary is much disputed. The studies of the amnesic patients of this group showed difficulties of such a character that they could not be classed with those of the expressive or receptive disorders. Furthermore, in those cases examined over long intervals the amnesic characteristics were found to be persistent. In short, there was every indication that the amnesic difficulties represented a distinct type of disorder. The essential characteristic, a difficulty in evoking words as names, appears in various forms of language response, notably speaking, reading, and writing. In these patients there was no indication of a fundamental disorder such as Goldstein postulates in a loss of categorical behavior.

---

[3] None of the cases showed clearly the picture of conduction aphasia, with great disturbances in repetition, some disturbances in spontaneous speaking, and comparatively little difficulty in understanding. The authors are inclined to class such conditions with the large group of receptive disorders, and thus to agree with Pick but disagree with Goldstein in his differentiation of "central" aphasia and with Kleist, Isserlin, and the many other investigators who consider conduction aphasia an independent form.

4. APRAXIA AND AGNOSIA

Much of the modern work on apraxia and agnosia reminds one of the older doctrines of aphasia in which the authors set up certain forms of disorder such as agraphia, alexia, and word-deafness, basing their conceptions on artificial differentiations of cerebral "centers" and connecting intracerebral tracts. It has been shown in so far as aphasia is concerned that such classification has no basis either in the results of psychological examinations or in definite knowledge of intracerebral fiber connections. The same condition seems to be true for the various types of apraxia and agnosia. As they have been predicated by different authors, at least from the structural point of view, they have as their basis only the theory of the author.

The recent publication of Kleist is an example of this method of procedure. Supposedly independent types of disorder are postulated from an analysis of the psychological processes and a minute differentiation of cerebral centers and connecting tracts. Each of these types is thought to be supported by clinical findings if the particular symptoms which characterize it do not always appear in connection with any other set of symptoms. The various types are not based upon decisive pathological data, for the material is composed of traumatic injuries to the brain which are notoriously untrustworthy. Kleist is not alone in this attack on the problem, but it is by no means universal. There is a well-marked tendency of the dynamic school to turn away from the differentiations of distinct types of disorder and the anatomical bases of these, and study rather the nature of the disorder in its actual complexity. This trend is much more hopeful for progress in understanding these very intricate problems.

In the light of our findings the most significant work within recent years has been the attempt made by such investigators as Morlaàs, Lhermitte, Grünbaum, Lange, and Klein to analyze the complex disorders which show both apraxia and agnosia and to study the essential nature of the difficulties in spatial orientation and construction. The progress already made has proved that perception, like movement, must be considered as an activity; that in most disturbances apraxic and agnosic factors are closely mingled; and that the disorders involve a more extensive field of mental functioning than was formerly supposed but are still not general mental deteriorations. The essential nature of the disorders, while already attacked from many angles, is still largely undetermined, and in all probability varies as it does in aphasia, not only according to the nature of the pathology but also according to the characteristics of mental functioning in the individual, his training, his aptitudes, and so forth. It is therefore of great importance to understand the behavior of normal persons on the non-verbal performances in question, and in all analyses of the abnormal performances to take into account the differences between normal persons not only in the level but also in the qualitative characteristics of mental functioning.

5. LOCALIZATION OF LESIONS IN APHASIA

Our views on localization so far as it concerns language differ from those largely held by the localizationist in that we believe that it is impossible to delimit areas for the language function or any of its processes. The statement of Hughlings Jackson, made almost seventy years ago, that "To locate the damage which destroys speech and to locate speech are two different things," is just as true today as it was then.

It is evident that it is impossible to localize language. In the majority of individuals language permeates the thought processes to such an extent that the one cannot be separated from the other; and for the present at least it is impossible to give an adequate explanation of intelligence, much less to localize it. That it is the result of the activity of the entire brain, however, there is no doubt.

As has been emphasized, our findings demonstrate that aphasia is predominantly a language disorder but that in practically all cases there are alterations in the so-called non-language activities, in the reaction to practical situations of daily life, and in social responses and attitudes. The first of these, the language disorders, are dependent upon the site, extent, and nature of the lesion, the second and third upon the disturbance of the normal functioning of the whole brain brought about by the interruption of the afferent and efferent fibers within the lesion.

We have little definite evidence to offer as regards the site and extent of the lesions. All the evidence with the exception of three necropsies consists of clinical symptomatology. This, however, indicates that in about 95 per cent of the cases the lesion must be in the dominant hemisphere; and that it must implicate the anterior and to a less extent the posterior part of the brain within certain limits, including the lower portion of the precentral convolution and probably the adjoining part of the frontal lobe, the lower portion of the parietal lobe, the upper part of the temporal lobe, and the anterior part of the occipital. In all of our cases the anterior and posterior zones were always implicated but to a different degree. In the expressive group the lesion is mostly in the anterior zone; in the receptive there is relatively greater implication of the posterior area; and in the expressive-receptive group anterior and posterior areas are more likely to be fairly equally involved. The lesion in the amnesic type is less definite but may implicate most of one hemisphere unequally. With regard to the area as a whole, that described above is not definite, as, for example, the zones outlined by Marie. It does not resemble the localization defined by Head, and based on a clinical classification at variance with ours and on traumatic cases. Nor does it resemble in any way the latest views advanced, those of Kleist, for it is impossible for us to subscribe to the highly differentiated areas he has outlined.

But the chief reason why it is impossible to localize speech disturbances is presented by physiological considerations. Recent evidence shows that the nerve impulses in the brain have the same character as those in the peripheral nerve, that is, consist of waves of electrical energy.[4] Adrian finds that visual cortical activity occurs in rhythmic waves. Such visual activity is less than that which would be called forth by speech, which encompasses motor, kinaesthetic, auditory, and visual impulses. As a result of any lesion two conditions are brought about. The negative, what the patient cannot do, and the positive, that is, what speech he can produce. The latter is the result of the physiological activity of the uninjured brain. Such a process, speech, is a live dynamic electrical function and cannot be measured.

[4] Sir Charles Sherrington, *The Brain and its Mechanism* (New York: Macmillan, 1933), 35; E. D. Adrian, *Electrical Activity of the Nervous System*, Address before the American Neurological Association, June 6, 1934.

Throughout the literature from the time of Jackson to the most recent work of Kleist there is a continual reference to the part played by the right brain in the general function of language. While Jackson definitely believed that the "faculty" of language could not be localized anywhere except in the whole brain, he nevertheless differentiated between the language functions of the two hemispheres. To the right hemisphere he assigned the function of "receiving" speech, and wrote as follows:

> To coin the word verbalising to include all ways in which words serve, I would assert that both halves of the brain are alike, in that each serves in *verbalising*. That the left does is evident, because damage of it makes a man speechless. That the right does is inferrible, because the speechless man understands all I say to him on ordinary matters. And yet since the patient cannot repeat after me, even in writing, the proposition he so readily understands (since he can only receive it and cannot give it out), it follows that the word processes which remain in his right undamaged hemisphere are not of the same kind as those by which speech results. In other terms, word processes are not of the same kind in each half of the brain.

He also attributed some expressive functions to the right hemisphere, namely, the lower forms of emotional and automatic speech responses. It seems to us that such reasoning is fallacious for it is based on the assumption that the hemispheres have a selectivity in the part they play in the development of language as well as in their activity following injury. Moreover, in assuming that the uninjured part of the brain has such function the fact is not considered that however speech is expressed, whether through the activity of the right or left brain, it can be and must be because of the activity of the same parts, in the injured as well as in the uninjured brain. As Pick has well said, there is no clinical evidence to support Jackson's views on the part played by the right hemisphere. The more automatic processes in language and behavior differ from the less automatic in functional nature, but not in point of localization.

Following Jackson, other authors have assigned definite speech functions to the right hemisphere. This is true not only of those who believe that the functions of speech reception are more bilaterally represented than the functions of expression, but also of those authors like Von Mayendorf, who explain various characteristics of the abnormal language and behavior, notably paraphasia, paragrammatism, and paragnosia, as the result of the activity of the right hemisphere. As Kleist notes in his recent work, there is no reason to suppose that the activity of the right hemisphere, or of any part of the brain remaining uninjured, differs in kind from the activity which was characteristic of it before the injury. The lesion undoubtedly leads to a different organization of cerebral activity as a whole but not to a change in the nature of the functioning of any part. Finally, against all this assumption as to the functioning of the right hemisphere, we call attention to the psychological changes found in the cases of right-sided lesion without aphasia or history of it, consisting of some diminution of intellectual functioning not at all like that found in aphasics.

XX

CONCLUSION

THE specific results of the study and the discussions of aphasia as a problem of cerebral and mental functioning have been summarized throughout the book as the material was presented. In the previous chapter a general review of the concepts developed has been made and these have been compared with current views. In conclusion there need be no further summarizing, but it is important to point out, first, the value of the work from the practical point of view and, second, the general concept of aphasia which the clinical and psychological findings require.

The first and most important contribution with regard to the practical problems of diagnosis or treatment in aphasia is the establishment of a satisfactory system of examination. The battery of tests outlined in Chapter VI will seem impractical when patients are many and time is short. Fortunately, while even this battery is incomplete for thorough research work, it can be abbreviated, as described in Appendix II, to series of tests which should give a fair estimation of the nature and extent of the aphasic disorder in two or three hours. Even these short test series may be too long in some cases. The trained investigator, who understands not only the application but the interpretation of the tests, will often be able to abbreviate still further. The important point is that a fairly complete series of tests should be available for use in difficult cases where, for example, the determination of an aphasia might aid in diagnosing a tumor, or in cases where reeducation is planned.

Gross aphasic defects are readily determined, but all the slighter or more complex changes require a knowledge of the behavior of normal adults. The second important contribution of the research is the comparable study of normal adults and the more accurate determinations of the aphasic disorder consequent thereon. Representing as it does a fairly satisfactory sample of the middle levels of the population, this adult group not only serves as a basis for the estimation of the disturbances shown by the aphasic and non-aphasic cases of cerebral lesion in this research, but it could well be used for other studies of abnormal adults with changes or possible changes in mental functioning, for example, of patients with any of the psychoses and dementias or encephalitides. Lack of knowledge of the range and characteristics of normal responses has always constituted one of the major difficulties facing such work. Naturally it is not claimed that the facts of normal behavior determined in this research are sufficiently complete to be used as a basis for any study of abnormal mental functioning. It is true, however, that many of the important facts are determined, and moreover that the method of studying normal behavior through examination of patients such as those admitted to the hospital for orthopedic or minor surgical treatment is both practical and satisfactory and should be further employed.

A third contribution of practical as well as theoretical importance is the simple and relatively easily followed classification with the four divisions of expressive, receptive, expressive-receptive, and amnesic types of disorder. This classification preserves the main groups of the classical doctrine, with considerable differences in the concepts of the disorder, but it is a simplification of the usual outline of aphasic disorders whether classical or modern. The simplification arises from the fact that the actual studies of the sixty aphasic patients of the group showed no examples of any of the so-called pure forms of disorder, or of any of the subordinate classes such as the transcortical aphasias or conduction aphasia. Admittedly the fourfold division here adopted is not so simple as the ordinary classification of motor or sensory disorders, but this twofold division is not justified by the facts. In addition to the predominantly expressive and predominantly receptive disorders, there are severe expressive-receptive disorders affecting all language processes, and there is also the amnesic disorder, which hinders expression in a different way from the predominantly expressive type and so must be established as a separate group.

From the practical standpoint finally are to be noted the facts on the course of the disorder and the suggestions as to reeducation for aphasic patients. No standard system of reeducation can be outlined. The specific methods used depend on the characteristics of the individual case as determined by thorough preliminary examinations. Nevertheless some of the methods cited can be used in many cases. The whole problem of reeducation in aphasia requires more accurate work and more complete reporting than it has ever had. The pertinent cases in this research are few, but because they are more thoroughly studied than most of those in the literature they assume a particular importance.

As to the significance of the findings for an understanding of the nature of aphasia, certain definite statements can be made. With regard to the pathological substratum, it is clear that the lesion must be within a given area which includes both anterior and posterior parts of the brain. By the anterior part is meant the pre-central convolution and the adjacent parts of the frontal lobe, the pre-motor area. The posterior part includes the inferior portions of the post-central and parietal lobes, the superior part of the temporal lobe, and the anterior part of the occipital. How much of the subcortex is involved it is impossible for us to say. These statements are indefinite and are intended to be so, for there are no more conclusive data in our work and no more definite findings in the literature. The various surveys of the pathology of aphasia would seem to indicate that the lesion must almost always be in the dominant hemisphere and must include the motor, sensory, and temporal zones so as to affect those parts of the brain concerned with motor, kinaesthetic, and auditory activities.

The findings of this research are similar. In all of our expressive types of aphasia the lesion involved the anterior and, to a less extent, the posterior parts of the brain. In the predominantly receptive types, the lesion again included the anterior as well as the posterior part of the brain, the posterior being more implicated than in the expressive group. In the expressive-receptive types both anterior and posterior parts were more or less equally involved. So far as the amnesic type is concerned no definite statement can be made for the cases were too few, but it would seem that this special disorder can appear with either a large or a small lesion. In the case in which the amnesic disorders appeared with a small lesion, however, the aphasic manifestations were transitory.

If pathological inferences are permissible from the psychological results, it is pertinent to point out the following conditions:

1. The chief psychological changes consisted of: a) predominant disturbances in language; b) disturbances in so-called non-language activities; and c) alterations in common everyday activities and social behavior. It is obvious that the psychological language disturbances have as their basis the pathological lesion in the area defined above and that the type of disorder is dependent on the site, the extent, and the nature of the lesion. It is also necessary to point out here that a lesion anywhere else but within the limited region crudely outlined does not produce aphasia. From this standpoint, at least, the negative findings are more important than the positive.

2. While it is impossible to determine any specific areas underlying non-language activities, it is clear that although they are to some extent dependent on

verbal formulations, that is, on the locale of the lesion in the area described above, they may be partly or altogether independent of language. They undoubtedly require the normal activities of both hemispheres. The motor and kinaesthetic factors indicate this and the visual factors, which are always involved, point even more definitely to activity of both sides of the brain. From the pathological point of view it is clear that any lesion producing aphasic disorders must interfere with the efferent and afferent fibers subserving non-language activities. In other words, the original lesion is sufficient to lead to disturbances in non-language performances without predicating a separate pathology. An evidence of this is the fact that non-language activities were deteriorated in cases of right-sided lesion without aphasia.

3. What has been said in the previous paragraph about non-language activities is equally true of everyday practical and social behavior, that is, both hemispheres subserve such behavior, and lesions of what might be called the pathological aphasic zone interfering with the efferent and afferent fibers bring about a disturbance of normal activities in these fields.

A further point to be considered is the variation in mental functioning in the individual. There is no doubt that the aphasic disorder, while it may not vary in type, nevertheless assumes different characteristics according to the nature of the mental functioning in the individual case and the extent of development of the different cerebral areas.

The views presented here show the anatomical substratum for the psychological findings and the fact that lesions of certain parts of the brain bring about certain types of disorders. It is necessary finally to emphasize that the various clinical and psychological manifestations are the result of the activity of the parts of the brain which are still capable of functioning and are the expression of the dynamic activity of these parts.

APPENDIX I

CASE REPORTS

1. Expressive disorders
   - No. 10, vascular
   - No. 20, vascular
   - No. 21, vascular
   - No. 43, vascular
   - No. 48, tumor
   - No. 51, traumatic
   - No. 59, tumor
2. Receptive disorders
   - No. 1, vascular
   - No. 35, traumatic
   - No. 56, vascular
   - No. 60, tumor
3. Expressive-receptive disorders
   - No. 3, vascular
   - No. 19, traumatic
   - No. 26, vascular
4. Amnesic disorders
   - No. 17, tumor
   - No. 18, tumor
   - No. 42, tumor
   - No. 47, tumor

I. EXPRESSIVE DISORDERS

No. 10. *A case of predominantly expressive disorder with marked difficulty in articulation and word-formation. The lesion was probably a thrombosis of the right middle cerebral artery.*

Female, white, 57; waitress and for 7 years the only support of her husband and 2 children; approximately 3 grades of primary school; right handed, but can do many things with the left hand.[1]

Psychological Summary

The aphasia was predominantly expressive with severe difficulty in articulation and word-formation which improved somewhat in the course of a year's study, and with extensive disturbances in other language and non-language performances. Having had little education, the patient would not have been expected to reach the normal medians in reading, writing, or arithmetic. In judging her performances, however, it must be noted that she had been a capable woman, able to support her family over a long period when her husband was drunk or ill, and that she was probably closer to the average in intellectual than in educational level. It seemed clear that all language processes were somewhat disturbed, with the understanding of spoken language probably least affected. Non-language performances were apparently affected as well and were considerably lower than would be usual in a woman as capable in the practical problems of housekeeping as No. 10.

---

[1] One of the patient's two children was left handed and there was some left-handedness in her family but not in her husband's. She scrubbed with her left hand and used the left more than a completely right-handed person in sewing and ironing. The Miles A-B-C Vision Test seemed to indicate that she used her left eye in sighting.

This patient's examination consisted of one or two hours' work a week over a period of a year. During this time she was given some little specific speech training in addition to that consequent upon the psychological studies. Her speaking and writing and various other activities dependent on spoken expression improved, but there was no great or extensive progress. At a second examination six months after the first, test scores were higher but many of them still fell outside the normal distributions. The study was then taken over by another examiner who repeated most of the tests, with results very similar to those of the second examination.

No. 10 was extremely cooperative and friendly. She worked hard but liked to stop to talk between examinations. She was little disturbed by failures in reading, writing, or arithmetic, attributing them to her poor education. She was anxious to improve her speech, but too much engrossed in family affairs and household management to practice much. Although she did not recognize the extent of the disorder, her insight was fair.

Her behavior in the practical situations which she met every day and her relationship with her family seemed normal. Her daughter and son-in-law had moved into the house to care for her after her illness, but as soon as she was well enough to be around, about the time the examinations were started, she began to prepare the meals herself and to take over the household expenses. She was much concerned because her daughter was extravagant and her son-in-law without a job, and her anxiety seemed justified. She took charge of her husband's pay check whenever possible and hid it securely until the collector came around for the rent. Once the examiner happened to be there when she had no money for the rent, and heard her convince the collector that it was her daughter's turn to pay the rent and that her daughter was out. Her daughter was really sleeping upstairs and seemed to have nothing to do with the matter. In a few months the whole family moved, and the patient and her husband and son took a small house by themselves which the patient had complete charge of. The fact that her practical and social reactions were fairly adequate is particularly important, because the aphasia was severe and disturbances were evident in many processes.

Neurological Summary

About 4 months before she was studied the patient developed a complete left hemiplegia and aphasia and the only thing which she could say was "Oh boy!" It was supposed that there was some disturbance of sensation on the left side, but this could not be definitely determined. When examined the hemiplegia had receded, leaving a drooping of the left face and moderate weakness of the left arm and to a less extent of the left leg. The reflexes on this side were increased and the Babinski was uncertain. Sensation was normal.

Psychological examination was begun about one month later. During the year that she was observed the weakness in the left side disappeared to a large extent but the improvement in her speech was less marked.

The lesion was probably thrombotic involving the right middle cerebral artery, chiefly in the motor zone.

Psychological Report

Speaking. Immediately after the attack the patient's *spontaneous speech* was reported to consist of a few words and speech sounds which she articulated poorly and with great effort. The only word she used regularly was "boy," and by this means she called her only son to whom she was much devoted. When first examined five months after the attack, she attempted to speak more extensively but her expression was very severely handicapped both by difficulties in articulation and word-formation and by poverty of words. She was well aware that her speech was often incomprehensible and would sometimes repeat a word again and again in an effort to make it clearer. These attempts were usually failures and they did not indicate that she had a satisfactory concept of the word-forms. Her recognition of the fact that her speech was unclear apparently did not hinder her from trying to speak, and she entered into all discussions, even when only one or two of her words were comprehensible.

Verbal or grammatical confusions were rarely observed in this case. Occasionally the patient confused "yes" and "no," but other verbal confusions were almost never found. Some, of course, might have been covered by the faulty word-formation.

During the year of repeated examinations and some slight training, the patient's speaking improved, but the character of her difficulties remained the same and failures in articulation and word-formation and fragmentary speech were still evident at the end of the period. The extent of her improvement may be suggested by two typical speech records, the first taken five months and the second fourteen months after the attack.

1. (Husband explained that daughter was ill in bed, and No. 10 continued:) Dotter . . . de heart . . . daughter . . . nervous . . . ups an' 'ouns . . . ups an' downs . . . . (Did you go driving over the week-end?) Well, I didn't . . . well . . . . (Didn't go?) Yes, Yes! . . . I was of too . . . good . . . . (Has your son changed his car?) No, No! . . . filed . . . pee . . . noted . . . himdown . . . and sauld . . . sauld . . . cherard . . . (Husband said that she meant it stalled at the Girard Estate.) . . . horrter an' twentieth . . . wock an I mended . . . I jus' pulled on home.
2. (Telling what kind of work she used to do.) Mrs. Patterson . . . oust

> to be . . . used to be . . . used to be waitress . . ., two chambermaids . . . two kitchens . . . and this 'ere dishwasher and everything . . . seven of them . . . er, er . . . thirteen of 'em at . . . . I like it dere . . . like it dere . . . waitress . . . candles 'ere (Gestured to show how candles were put on the table.) We would, I would . . . one, two . . . one, two . . . candles . . . this 'ere shades; silver candles, this 'ere cut glass, this 'ere roses . . . I like it . . . uh, sweet! Lay down this 'ere . . . plate (Gestured to show how she would put down the plate.)

While the fragmentary nature of the speech is still obvious in the second record, it is noteworthy that the patient was by this time able to express her meaning more completely and had command of a larger vocabulary.

From the beginning the patient's reactive and automatic speech was more easily and correctly articulated than her other speech responses. *Reactive expressions,* such as "No, listen to me, I can't do that!" often stood out clearly in the midst of very poorly articulated and inadequate sentences.

Automatic word series were also superior in articulation. The patient at first made some errors in counting above 12 or 15, but was soon able to count through 50 or 100 correctly and clearly, and also to count by 2's and 5's. She could say the names of the days of the week without error, but at first she made one or two errors in saying the months of the year. On her first attempt at the alphabet, she failed after "g," and required several promptings before she could finish. After two or three repetitions, however, she regained her customary way of saying the alphabet very fast, in marked rhythm and with "zed" for "z"—and thereafter she always said it correctly. Even then she did not always place a series of block letters without error. On her first trial she made two mistakes which she did not correct: she said "o" but placed "Q," and said "q" but placed "U." The first difficulty apparently arose through similarity in letter form and the second through similarity in sound.

NAMING. In naming objects or pictures of objects No. 10 even at first made few errors apart from those in articulation and word-formation, and she could select the objects of Head's Test to oral or printed command. She could name all the colors of Head's Test except "purple" on the first trial, and she obviously recognized this color for she said: "It's Easter." On later trials she named all the colors correctly.

REPEATING. No. 10 made some errors in repeating single words or short phrases and the errors increased with the longer sentences. In nature they were like the errors of her spontaneous speaking, and there was on the whole little difference between the quality of speaking and repeating. Sometimes, however, when she failed to produce a word in speaking and the examiner pronounced it for her, she could then repeat it correctly. At the same time when she became much confused over a word she was not aided by having it pronounced for her, and the only solution was for her to relax and start all over again.

UNDERSTANDING SPOKEN LANGUAGE. The patient's understanding of spoken language was clearly limited for a person of her probable mental level, but nevertheless superior to other language processes. She understood ordinary conversation, and all simple directions and questions. She carried out many fairly complicated directions and was successful in 12 of 16 of the oral commands of Head's Hand, Ear, and Eye Test. The spatial directions of the Kuhlmann Comprehension Tests and the Abelson Geometrical Figures Tests presented difficult problems for her, however, and she was never able to respond correctly on more than two or three items. Her difficulties seemed to arise as soon as spatial directions had to be related to a schema presented visually. They are undoubtedly to be considered in connection with the difficulties she experienced on most of the non-language tests.

Reading. The patient's *oral reading* was monotonous, but her articulation in reading was much superior to that in speaking. She was about as slow as the poorest of the literate normals and she made many errors in reading single words as well as connected text, but in view of her poor education and her severe difficulty in speaking she read extraordinarily well. Most of her errors were mispronunciations.[2] Her attempts at long words such as "reverence" were interesting for they often showed that after spelling the word letter by letter she could finally pronounce it.

TABLE XX

SCORES ON GRAY ORAL READING TESTS: CASE NO. 10

(Sets increase in difficulty from II through III)

MONTHS AFTER ATTACK	SET II (150 words)			SET III (150 words)		
	Time	*Errors*	*Form of test*	*Time*	*Errors*	*Form of test*
5	240″	10	2	350″	28	2
6				255″	19	5
7	103″	7	2	170″	18	4
8				172″	16	2
			Summer vacation			
10				125″	14	2
12				123″	10	5
14				165″	10	4
17	85″	5	2	130″	10	2

---

[2] No. 10 did poorly on all the Gates Tests of Visual Perception and Selection, but had greater difficulty with the letters and words than with the numbers or the meaningless figures.

Oral reading, like speaking, showed fair progress over the study period of a year. The figures in Table XX, page 479, show the extent of the improvement in both speed and accuracy of reading, and are of particular importance as an instance of the regularity characterizing the improvement in cases of aphasia.

The patient's *understanding of printed material* was very limited, slightly below the level of the poorest literate normals. According to her daughter, she had never been "one to read a book," and her understanding in reading had undoubtedly always been below normal averages, and relatively less satisfactory than her understanding of spoken language. The surprising fact about her reading as a whole was not her limited comprehension, but her comparatively superior oral reading.

Writing. After the attack the patient did not try to write until the time of the examination. Her *spontaneous writing* was then limited to a few words: she usually succeeded in spelling her last name and her son's first name, but beyond these she made many errors. Two months later she attempted simple sentences, such as *"Jhon thoot two* nice," meaning "John (her son) looks too nice." She was not satisfied with the first two words and insisted that they be written out correctly for her to copy. She practiced copying a little during the course of the year's study but she never could be induced to do much spontaneous writing. Nevertheless a definite improvement was evident, and may be estimated from the following letter written under observation just a year after the attack and seven and a half months after the beginning of the examination:

> Tues 27/31
>
> Dear Miss McBride
> Well I Will ask you
> to write to me. I did not see Jack
> come in he is going to make tea in a cup
> and dad (li   ) to the fit.
> ~~I was~~ I don't now why yaw[3]

No. 10 made about as much improvement in *writing to dictation* as in spontaneous writing. Repeated tests of word dictation by successive forms of the Morrison McCall Spelling Scale showed considerable progress during the year: on the later tests she reached the level of the poorest literate normals. The errors she made showed nothing unusual in comparison with those of the normal group. After the first few weeks faulty letter formation was rare, and her mistakes in letter forms probably depend on her unfamiliarity with writing as well as on the aphasic disorder.

In *oral spelling* No. 10 fell among the poorest of the literate normals on the first examination and did not improve during the course of the study. Her spelling had probably always been low grade.

---

[3] The word attempted and given up in the fourth line of the letter is "listen" or "listening," and the final word in that line "fight." The final word in the next line is "yawn."

From the beginning she could *copy* most single words correctly but the work was laborious for her and in copying sentences she was likely to make frequent errors.

Arithmetic. On both printed *arithmetic computations* and *arithmetic problems,* No. 10 did only a little better than the poorest of the normal group. She had great difficulty with all printed computations except simple additions, and in doing the latter, she counted up the sum on her fingers. She had probably never progressed beyond this method, and never done well in arithmetic. She was very uncertain of the significance of the symbols for the different arithmetic processes, and of the words "plus," "minus," "multiply," etc. It was interesting to find that she was nevertheless almost always successful in solving simple oral arithmetic problems, such as those having to do with making change.

At the same time she was unable to answer many of the comparatively simple questions involving number words. She could not, for example, tell the number of minutes in an hour, of hours in a day, of days in a month, or of cents or dimes in a dollar. She was oriented for time but could not tell the time from a clock, and not only made such errors as saying "quarter to" for "quarter past" but also confused the hours.

She could read or write to dictation one- or two-place numbers, but began to make many errors with three-place numbers. She understood the series meaning of numbers and could almost always tell the one coming before or after a given number. She also understood the relational meaning to some extent and could tell which of two numbers was larger.

Performances on language intelligence tests. Responses on the language intelligence tests were at first seriously affected by the difficulties in expression. On the first trial the patient was able to give only five responses on the *Oral Opposites Test* in 5 minutes and only three of these were correct. Six months later she gave 13 correct responses in 2½ minutes, a performance still under the lower quartiles for the normal group. On the last examination a year after the first she was quicker but still below the lower quartiles in speed and quality scores on both Opposites and Part-Whole Tests. It is noteworthy that she understood the problems of these tests and did not lose the controlling principle as the test progressed. On both *Oral* and *Printed Analogies Tests* where speed was not a factor she stood higher in relation to the normal group than on the Opposites or Part-Whole Tests, but still below the lower quartiles for the normals.

She had the same position among the lowest quarter of the normals on the *Sentence Completion,* the *Oral Absurdities,* and the *Thorndike Test of Word Knowledge* and it seemed clear that her language abilities had probably never been well developed. At the same time *Oral Vocabulary* as indicated by the Stanford Binet Vocabulary Test—a problem more nearly within the range of her experience—was superior to the other language performances and slightly above the lower quartile for the normal group.

Reproduction of verbal material. The oral reproduction of verbal material was handicapped by the patient's difficulties in expression; she could repeat only five numbers or letters, four nonsense syllables or disconnected words and sentences of six or seven syllables. After a year, when her speaking was better, she could repeat some sentences of as many as twelve or thirteen syllables without error. The length of the number or letter sequence she could reproduce was the same whether the material was presented orally or in print.

Experiments with the Ranschburg Word Pairs showed that the patient could reproduce three pairs but not four.

NON-LANGUAGE PERFORMANCES. For a woman who could deal with the practical tasks involved in cooking, ironing, cleaning, hanging curtains, and so forth, this patient had unusual difficulty with non-language performances. She did not adjust well to many of the tests: she made a good effort but the problems puzzled her.

The *formboards* of the Shorter Pintner Paterson Performance Scale showed that she worked fairly rapidly but without adequate understanding of the forms and their relationships. On all except the Healy Puzzle A, her scores were considerably below the lower quartiles for the normal group, and she was unable to finish either the Two-Figure Board or the Feature Profile Test.

She understood the problem of the *Digit-Symbol Substitution Tests,* but worked so slowly and inaccurately that she always fell far below the lower quartiles for the normal group (Woodworth Wells Substitution Test and Easy and Hard Learning Tests of the Pintner Non-Language Scale).

She had great difficulty *imitating patterns* traced by the examiner on a row of four dots or cubes, and again came within normal ranges but considerably under the lower quartiles (Knox Cube Test and Imitation Test).

On *Picture* and *Drawing Completion Tests* she stood slightly higher in relation to the normal distribution but still not up to the lower quartiles. Her remarks on the Drawing Completion Test showed that her grasp of the pictures was sometimes inadequate. For instance, she added two fingers instead of a cigarette to complete the picture of a man smoking.

The problem of the *Reversed Drawing Test* was particularly difficult for her to grasp and on the first trial she completed only one item successfully. Her adjustment to the *Picture Reconstruction Test,* where the problem is also difficult for some aphasics and some normals, was fairly good, however, and her score surpassed the lower quartile of the normal scores.

Her *drawing of a chair* from a model was a poor construction with a back, a seat, and four legs but no perspective whatsoever. It would hardly be recognized as a chair by the uninformed.

The *drawing of a man* scored on the Goodenough Scale would fall among the lowest quarter of the normal drawings, and was a very primitive, schematic representation.

No. 10 had great difficulty in tracing the *Porteus Mazes,* though she worked slowly and stopped at every turning-point. Her score was considerably below the lowest quartiles for the normal group, and probably indicated not a lack of "foresight" but an inability to make the necessary visual analyses of the mazes.

No. 20. *A case of predominantly expressive disorder showing marked abbreviations in speaking and writing, and severe disturbances in many language and non-language processes. The patient was particularly interesting because he was apparently right handed and yet the weakness and sensory disturbances were on the left. The lesion was probably a thrombosis of the right middle cerebral artery involving the central, parietal, occipital, and temporal convolutions.*

Male, white, 50; teamster; parochial school, about four grades; right handed.

Psychological Summary

The aphasia was predominantly expressive, with all language performances extremely defective and many non-language performances disturbed. The most striking characteristic of the case was the tendency to an abbreviated performance in every type of language expression, and probably in non-language responses as well. Speech was fragmentary and incomplete, although not seriously handicapped by difficulty in producing words. In writing, where the abbreviation was most obvious, the chief errors consisted of incompletely formed letters and of letter and word omissions. In reading there were frequent omissions of words or parts of words. The shortened products were sometimes recognized and corrected by the patient.

During the twenty months of observation, there were no appreciable changes in the level of the patient's performances or in their quality.

Despite the fact that No. 20 showed extensive language and non-language disorders and that he had greater difficulty in adapting to some of the more artificial test situations than his poor understanding would explain, there was no general deterioration. During the period of study he left the hospital several times for a month or so, and apparently got along fairly well outside, doing odd jobs when he could find them and coming back to the hospital when he thought he needed further treatment.

His social relationships were normal, although he was occasionally irritable because of pain and discouragement. He cooperated as well as he could. His attitude during the examinations was normal; he appreciated the humorous situations which sometimes occurred and he responded well to encouragement.

Neurological Summary

The patient was first admitted to the Psychopathic Ward of the Philadelphia General Hospital. The prior history was never obtained but he was supposed to have had convulsions with speech disturbance two years before. The neurological examination revealed a left hemiplegia with the usual increase of tone, reflexes, and Babinski. There was also a slight impairment of sensation on the entire left side of the body with disturbance of touch, temperature and pain, vibration, muscle sense, and some astereognosis in the left hand. It was impossible to delimit these sensory disturbances because of their diffuse character. Ophthalmoscopic examination showed a moderate angiosclerosis and there was an irregular limitation of the visual fields. Blood Wassermann and spinal fluid studies were altogether negative, and x-ray findings were negative. Psychological studies were begun several months after his admission and continued for a year and eight months. During this time the neurological condition was more or less stable, the motor and sensory disturbances remaining about the same. Occasionally the patient had convulsive attacks.

The lesion was probably a thrombosis of the right middle cerebral artery involving the central, parietal, occipital, and temporal convolutions. The possibility of the presence of a tumor was ruled out by the course of the symptoms.

Psychological Report

Speaking. *Spontaneous speech* was plentiful, but abbreviated and fragmentary. The following speech record was characteristic:

> My cheek . . . my cheek . . . creep alle time . . . alle time . . . jus' like quarter head . . . but the main is my shoulder . . . is . . . er numb . . . just like sleepin' . . . alle time . . . my cheek . . . very annoyance . . . main is my shoulder . . . achin' all round here . . . my hands . . . like pins an' needles.

It was obvious that this "broken talk," of which the patient frequently complained, did not result from hesitations for words; the essential words were present and were readily produced. The breaks depended rather on the omission of many words and phrases which would have been included in normal speech. The record quoted above shows a second characteristic: repetition of those fragmentary expressions which constitute the speech. The omissions in this case did not seem to depend on the speech difficulty or the "speech need," for speech in its abbreviated form was plentiful and the repetitions might even be said to compensate in part for the loss of some of the natural form of expression.

Words were rarely misused and errors in grammatical constructions other than those consequent upon the word omissions were few.

No. 20 had difficulty with *automatic word series.* He could count correctly and with fair speed, and say the names of the days of the week, but he could never say the months or the alphabet without prompting.

Naming. No. 20 could name common objects rapidly and correctly.

Repeating. He could repeat short phrases and sentences without hesitation, and with a natural inflection. With sentences as long as ten syllables, however, he always omitted some part of the sentence, and he also mispronounced a word occasionally.

Understanding spoken language. The patient responded correctly to simple questions and directions, but often failed when these involved two or three key words, and always failed when they were longer or more complicated. He complained that he could not talk to people because he did not know what they said. Two forms of the Gates Word, Phrase, and Sentence Reading Test, the one given orally and the other as a reading test, showed that his understanding of spoken language was slightly better than his understanding of printed material. Both were far below the normal.

He was also far below the normal in his ability to understand and follow directions requiring spatial orientation. He could, however, make simple differentiations of left and right without error.

Reading. In *oral reading* of single words, No. 20 was not far below the performance typical of a man of his educational level. In reading aloud paragraph material of several degrees of difficulty, he did less well, making as many errors and reading as slowly as the poorest of the normal group. These errors frequently consisted of the omission of some of the small words of the sentence; for instance, he read:

> It today there every day. The trees green and pretty

for:

> I like to play there every day. The trees are green and pretty.

These omissions are apparently to be connected with the abbreviations of spontaneous speech and the word and letter omissions of writing.

In *reading comprehension* No. 20 was below the poorest of the normal group. An analysis of the results of the Gates Primary Reading Tests seemed to show that his difficulty depended chiefly on his having overlooked one or more of the words essential for a complete understanding; there were also errors which depended on his failure to grasp the full significance of a word which he read correctly.

Writing. The patient's handwriting was rather small but not beyond the limits of the normal. In writing, whether spontaneously or to dictation, he showed a strong tendency to crowd the words together and to put as many as possible on one line. In writing a series of words to dictation he would usually disregard repeated instructions to write one under the other in a column down the page, and would write one closely after the other in a row across the page.

At first, *spontaneous writing* was limited to the patient's name, the name of the hospital, or the date. Later he would write short sentences such as "I am gld met you," or "I fell rotten left side"; still later, letters such as the following:

> Dear friend I write lines the winter is coming
> tle uld wl some time my hed left
> the wind and storny oh iam no good.
> like alog somte very tired
> Yours turly
> Frnk ——

The increased length of the written product did not result from actual improvement but from his greater interest in writing and confidence in the examiner. His writing always showed, in addition to the more usual misspellings, very characteristic errors: the omission of words, making the writing abbreviated like the speech; the particular misspellings resulting from the omission of letters in the word, and from the omission of a part of the letter, so that "h" turned to "l," "w" to "u," "m" to "n," etc. He usually wrote his name correctly, but in signing the letter above, he omitted the vowel in his first name and one of the vowels in his family name.

These errors were also clear in his *writing to dictation*. When single words were dictated, the patient's score for correct spelling would place him in the lowest quarter of the normal group (Morrison McCall Spelling Scale). Some of the errors here depended on his failure to complete the letter, as in "tlat" for "that." Most of them were letter omissions such as appear in these words:

strk	(struck)
persl, pernl	(personal)
dress	(address)
kown	(known)
prhap	(perhaps)
agsnt	(against)

These errors occurred with extraordinary regularity in all but the simplest words. As the examples show, vowels were more frequently omitted than consonants. On the whole, the essential part of the word was thus better preserved; the situation is analogous to that in speech or writing where the product was abbreviated but the more essential words usually preserved.

The patient often spelled the word aloud as soon as it was dictated and just before he wrote it. Usually oral spelling tallied with the writing but sometimes it was more complete. This was the case for two of the examples above: after the word *struck* was dictated, he said "s t r o c k," but wrote "strk"; after the word *address,* he said "a d r e double s," but wrote "dress." Here his original concept of the word-form is superior to the written product, where there is of course the added problem of executing the correct letter forms in their proper sequence.

The errors through letter omissions, in such frequency, are definitely abnormal. They are much more prominent than all the patient's other errors together: the more normal misspellings, "there" for "their" or "strock" for "struck"; reversals such as "god" for "dog" or "rign" for "ring"; and instances of perseveration when a letter or syllable of an earlier word contaminated a later word.

In writing sentences to dictation, No. 20 just reached the level of the poorest of the normal group (Stanford Dictation Test). As in writing single words, he omitted parts of the letters of the word. In the sentence dictation he also omitted many of the small words of the sentence. The characteristic errors may be illustrated by these records from various sentence dictations:

Pick yolow pach	(Pick the yellow peach)
Nerly candy gone	(Nearly all the candy is gone)
fanly chicken diner	(The family had a chicken dinner)
I getting ty tred	(I am getting tired)

(In the last example, he made two attempts at the word "tired"; he often tried a word several times thus, but he never crossed out the mistakes.) Before writing he often repeated the sentence and spelled some of the words aloud. As in the writing of single words, his oral and his written performances did not always tally and his oral repetition was complete in several cases when he omitted articles, prepositions, or verbs in writing. Before writing the first sentence quoted above, for instance, he said quite correctly: "Pick the yellow peach." Before writing the last one, he said: "I am getting tired . . . t i r e d."

Tests of *oral spelling,* however, gave performances very like those of written spelling. Again the most frequent errors were letter omissions.

Tests of *spelling by means of block letters* were interesting because they too eliminated the automatic motor component of the actual writing process. The results of these tests showed about as many mistakes in spelling as those of the other tests, and for the most part the same types of mistake. Letter omissions were again frequent, but letter reversals were more prominent here than in oral or written spelling. His course in arranging the letters was especially significant: he would usually pick out in order and place the "main" letters of the word and after that add one or more of the missing letters. Thus it was clear that in spelling by block letters, as in oral or written spelling, he had the same tendency to omit letters. That he was more able to correct an incomplete or confused arrangement of the block letters than to correct his written spelling, probably depended on the greater objectivity of the block letter arrangements. In only one or two cases had he corrected the spelling errors or word omissions in his writing. One of these cases occurred after his writing "he ran work"; he read this as "he ran to work," and said as he inserted "to": "Oh, *to,* sometimes I forget."

It seemed likely that he might be better able to recognize his own errors if they were presented him in print at a later date, and thus appeared in a new and more objective situation. Some of his representative errors, both of single words and of complete sentences, were therefore printed in clear type on cards and paired with the correct form of the word or sentence. In almost every case the patient was able to choose the correct form with certainty. When, for instance, he was shown these sentences:

Church party tonight
The church party is tonight

he pointed to the first and said, "That's bad!" to the second and said, "That's good!" He then spontaneously pointed back to the first sentence and said: "That's bad . . . broken sentence." The phrase "broken sentence" was his own; he had been directed only to point to the "bad" sentence. He chose the complete and rejected the abbreviated spelling for each pair of words presented. His only difficulty in the whole experiment was with a few errors like the following:

Eat three apple.

Here he did not seem to be able to differentiate between this form and the correct form with the word "apples."

The abbreviation which was characteristic of his spontaneous writing and his writing to dictation, was also clear in *copying*. Whether he copied from script or from print into script, he omitted letters in words, made some letters incompletely, and omitted words in copying connected text. As this performance would indicate, he did not copy slavishly, but he usually referred to the text for every word. The destructive processes in the writing of that word then seemed to be the same as those affecting his writing spontaneously or to dictation.

Arithmetic. No. 20 was far below the poorest normal in both printed and oral *arithmetic computations*. He frequently misread the numbers or misunderstood them, but even when he repeated them correctly he almost always failed to give the correct combination. There was no indication that he understood any of the arithmetical symbols.

He clearly did not understand oral *arithmetic problems*, and, although he read printed problems fairly well, he could answer only one or two of the latter correctly. He confused the various numbers involved, and he showed no discrimination in selecting the arithmetical process.

Performances on language intelligence tests. The patient's disturbances were so severe that he could do little on language intelligence tests. Even with repeated illustrations, he could not understand the problem of the Opposites or of the Analogies Tests.

His score on the Sentence Completion Test equalled that of the poorest of the normal group. His failures were not the result of poor reading, but of a true inability to select the correct word for each blank. His most interesting error occurred when he was able to complete the sentence orally, but could not analyze this oral product or specify the one word in it which should be written in the blank space in the printed sentence.

He could name a number of objects within a given class, for instance, a number of flowers; thus he was not handicapped by any severe difficulty in evoking words nor by inability to recognize the objects which belonged together in a class.

When questioned as to the difference between two familiar objects, such as a "stone" and an "egg," he once or twice, through characterizing each object, pointed out a true difference, but in general he could do no more than make random comments on each name given him (Stanford Binet, Year VII). He was never able to point out an essential similarity between two objects (Stanford Binet, Year VIII).

No. 20 could define only about eighteen words of the Stanford Binet Vocabulary Test, a performance slightly lower than that of any of the normal subjects. Some of these definitions were very poor: they indicated his knowledge of the word, but were defective because of the disturbance in expression.

Reproduction of verbal material. No. 20 could repeat only four digits or letters immediately after their presentation, and sentences of less than ten syllables. His difficulty depended partly on defective reception of the material.

Many observations showed that he could reproduce experiences, and even definite verbal terms, after a considerable interval. For instance, after being questioned at the beginning of the study about his handedness in unimanual and bimanual activities, he was again questioned two months later. He answered patiently and then explained that he had already answered those questions before. He never failed to appear punctually at the specified time for work. Evidence of his ability to reproduce verbal material was clear from one of his comments on reading when he mentioned writers whose novels he had formerly enjoyed. He said that he had spent part of his life as a sailor, and named a number of countries and ports unfamiliar to the ordinary person of his education.

Non-language performances. The patient's responses to the non-language tests fell considerably below the normal medians. He was handicapped by sensory disturbances of the left hand, but he could use the preferred right hand skillfully. He used both hands in folding paper, in tying a series of good sailors' knots, and on some of the formboards.

He often had difficulty in understanding the problems of the non-language tests, problems which many patients with more severe language disorders had grasped easily. On some tests he would stop when he had finished a part of the work, saying, "I can't do that," or "That's all." At first these interruptions were thought to depend upon lack of interest or effort, but when they continued to occur in many tests at a time when the patient was making a great effort at all other types of work, it seemed possible that they were to be related to the abbreviations which characterized all his language productions.

Although he was kept working twice the maximum normal time, he did not complete three of the six *formboards* of the Shorter Pintner Performance Scale, the Casuist, the Healy Puzzle, or the Feature Profile. On the formboards he did complete he was far below the median of the normal group both in quality of performance and in speed.

He found the problem of the *Digit-Symbol Substitution Tests* very hard to understand, and, in spite of repeated instructions and demonstrations, would only write in a few numbers in series without regard to the symbols they should have accompanied.

All of the tests of the Pintner Non-Language Scale were difficult for him. On the *Reversed Drawing Test,* he only once added the correct line to make the second figure of the pair like the first only "turned over."

His performances on the *Picture* and *Drawing Completion Tests* were interesting in connection with his marked tendency to an abbreviated response. His score for the Picture Completion was not greatly inferior to the median of the normal group, but his behavior during the test was abnormal, for he stopped frequently and said that he had finished or that he could do no more. A similar situation developed with the Drawing Completion Test, on which he would have reached the median of the normal group had his drawings been more accurately made and placed. He recognized and named spontaneously the parts of the picture which were present, but in the first drawings of the series named the missing part only after repeated urging. Furthermore, in the first drawings, he then required more urging before he would sketch in the missing part he had named. Thus while his responses indicated that he recognized as many missing parts as does the normal person, he was slow in accepting the problem. He was anxious to cooperate, but had no impulse to complete the picture, and for a long time apparently could see no point in doing so.

In view of these findings on the Picture and Drawing Completion Tests, it was significant that the patient could not complete any one of a number of attempts to draw a *picture of a man.* Like the scores on these two Completion Tests, the score on the Goodenough Scale for his most complete drawing of a man was high in relation to his other performances; it was, in fact, up to the median score for the normal group. The drawing was badly out of proportion; only one leg was represented, without foot, and the parts below the neck were barely indicated; the head, however, was complete and fairly accurate in its detail. The patient's inability to finish the drawing by representing the legs and feet was all the more striking because of rather good representation of the head.

After several attempts which resulted in very incomplete sketches, No. 20 did succeed in *drawing a chair* from a model before him. The drawing was below the level of the median of the normal group, but it was complete in that his chair had a back, a seat, and four legs. There were not so many slats in the back, however, as there were in the model nor were all the rungs between the legs shown.

Only in copying a number of figures and patterns did the patient make really complete drawings. They were often out of proportion and inaccurate, but they included all the lines of the originals. It was natural that the copies should be more complete than the drawings from memory or from a model because they were undoubtedly simpler performances. In copying print, however, the product was abbreviated just as the spontaneous writing was, but probably only because the patient looked at a word and then wrote it down as a whole. Had he "drawn" the word line by line as he copied the drawings, his product would have been complete.

In tracing the *Porteus Mazes,* No. 20 worked slowly and carefully, but did only a little better than the poorest of the normal group. He used "foresight," that is, he regularly looked ahead to try to trace his path, but he was unable to do so in the more complicated mazes.

On the whole, performances on non-language tests showed that the problems involved were more difficult for No. 20 to approach than for many patients whose language disorders were equally severe, and more difficult for him to approach than were many of the language tests themselves. Another significant point was the frequent interruption in the response; the patient seemed unable to work through a test without repeated urging and encouragement. This characteristic might be related to his tendency to shorten all his language productions. In any case, his drawings, which were the more incomplete as they depended on his own original productions, showed that there was a tendency to shorten some non-language as well as language responses.

No. 21. *A case of predominantly expressive disorder with limited speech and marked difficulty in producing words. The lesion was probably a thrombosis of the left middle cerebral artery.*

Male, white, 50; sailor, and later a weaver; claimed to have had 8 grades of school; right handed.

Psychological Summary

The aphasia was predominantly expressive. The chief difficulty lay not in articulation or word-formation, although there were such disturbances, but in the production of words in spontaneous speaking. The patient was unlike the amnesic aphasic in that he could name objects fairly well. His spontaneous expression, however, was fragmentary and abbreviated. Understanding of spoken language was relatively well preserved but the patient had great difficulty in reading, writing, and arithmetic—all performances in which he had probably never been very capable. The limited expression and the word-poverty at first showed up clearly in speaking, and later, when speaking improved, were better demonstrated by the poor responses on language intelligence tests. Non-language performances were relatively superior to the language, but only in rare instances above the lower quartiles for the normal. As a sailor and later a weaver No. 21 was a man who would be expected to have considerable manual dexterity, although the enforced use of his left hand was of course a handicap. On the whole the non-language performances seemed to show clearly that some deterioration had taken place.

On the first examination four months after the attack the scores for most language tests fell below the normal distribution. Three years after the attack a complete new examination was made by another examiner. The patient had improved greatly in speaking and had made clear progress in most language and in many non-language performances.

No. 21 was always cooperative and good-natured. He was not often discouraged by his difficulties on the tests but he would sometimes try to explain them as the result of poor vision, lack of glasses, and so forth. He appreciated the nature of the disorder to some extent, but he did not realize its severity. He was a quiet, mild man, easy to care for in the ward, and he fitted well into the hospital routine.

Neurological Summary

The day before his admission to the Philadelphia General Hospital the patient was found paralyzed on the right side and unable to speak. Because of this it was impossible to obtain a history.

Examination showed a complete right hemiplegia with conjugate deviation of both eyes to the right, which disappeared in a few days. Gradually the right hemiparesis became less with the usual symptoms of increased reflexes and Babinski. Ocular examination showed a moderate angiosclerosis.

The psychological examinations were made four months after the onset and repeated over a period of three years.

The lesion was in the motor area, due to a thrombosis of the left middle cerebral artery.

Psychological Report

Speaking. When first examined four months after the attack the patient's *spontaneous speech* was very limited and showed some difficulty in articulation. He rarely spoke unless questioned, and his expression was always fragmentary. According to the hospital reports he had been able to produce only a few words immediately after the attack, but this severe aphasia had diminished rapidly during the first two weeks. At the time of the examination, however, some of his speech was still unintelligible for he not only articulated poorly but mumbled so that the words could not be differentiated. He complained chiefly of poverty of words, saying for example:

> I can think a lot now . . . pretty good . . . I used to . . . get stuck here. (Pointed to throat.) Very few names I can tink of.

During the next eight months his speech gradually became more free and plentiful and his articulation clearer. On reexamination a little more than three years after the attack, marked improvement was evident, but his expression was still somewhat fragmentary and abbreviated. The following speech record was typical:

> (Can you write a letter?) No, m'am. I scribble, you know. Sometimes I think of a word, then I can't think of it. Sometimes I want to write my sister

a letter but she says "no use." She comes up here to see me. She ain't been up in four weeks . . . five weeks. I guess must be sick. Used to be up twice a week. Come every Sunday she would. My sister . . . Province . . . used to come twice a month. My sister Annie, Providence, Rhode Island.

The only evidences of confusion in this patient's speech were the occasional substitutions of "no" for "yes" or vice versa, and these were present only during the early months of the examination. He never used other words wrongly or made grammatical errors other than those consequent on the abbreviated form of his expression or natural for his low cultural level.

Reactive speech responses did not appear to be better articulated or more extensive than his spontaneous expression.

Tried on *automatic word series* he could count correctly but with errors in pronunciation such as "fix" for "six." He could say the days of the week, although he did not pronounce them all correctly, but he could not say more than three or four of the names of the months. He could not say the alphabet on any of the first tests and could not arrange the sequence correctly when given a series of block letters. He was still unable to name the months of the year or to say or write the alphabet on the final examination three years after the attack.

NAMING. From the time of the first examination No. 21 could name familiar objects correctly and with little hesitation. A number of the words were badly articulated as "shizzers" for "scissors" and "mushes" for "matches." He had difficulty in naming colors, however, and not only failed to name some of the colors in Head's Test but misnamed some, saying "breen" for "red" and "orange" for "yellow." He could select both objects and colors to oral or printed command. When the Color-Naming Test was repeated after about six months, he made no errors, and he named the Kuhlmann Line Drawings at this time with only one error.

REPEATING. When first examined, No. 21 could repeat single words more accurately than he could pronounce them spontaneously, but he began to make errors in repeating phrases or sentences of six or seven syllables. As his articulation improved, he was able to repeat longer sections correctly. Constant difficulties with particular speech sounds were never observed, whether in spontaneous speaking or in repeating.

UNDERSTANDING SPOKEN LANGUAGE. From the beginning No. 21 could understand simple questions and follow easy directions, including those involving right-left orientation. He could also follow the more complicated spatial directions of the Kuhlmann Comprehension Test and Head's Hand, Ear, and Eye Test. He carried out the oral directions of Head's Clock Test, setting the hands correctly, but he failed six of the oral commands of the Coin Bowl Test, apparently because the latter represented a difficult test situation for him.

His understanding was not sufficient for an intelligent grasp of complex statements like the Absurdities or the Problems of Fact of the Stanford Binet Scale at the first examination; nor for the complete Absurdities Test at the final examination three years after the attack. At this later date the Abelson Geometrical Figures Test was also given; the patient made only seven correct responses, thus showing a very poor performance in comparison with the normal.

Reading. When asked to read, No. 21 at first always protested that he could not read because he had no glasses. Actually his vision was adequate enough, and when pressed, he admitted that he could see most of the print clearly, but that, "If I tak' anyting out of de paper, I wouldn' know what it is." He could read the phrases of Head's Man, Cat, and Dog Test with no errors other than the occasional substitution of plural for singular.

When he was examined again about three years after the attack, he no longer protested against reading. His oral reading was then slow and inaccurate, and comparable only to the performances of the poorest of the literate normals (Gray Oral Reading Paragraphs). He understood single familiar words fairly well (Gates Word Recognition Test). He had more difficulty, however, in understanding paragraph material, and on the whole his reading comprehension was at about the lower limit for the literate normals.

Writing. When first tested No. 21 was able to write his name *spontaneously,* but he claimed that he was unable to write anything else. The names of the objects and colors he attempted to write in the course of Head's Tests were grossly misformed, for instance: "kyelf" for "knife," "blure" for "blue," and "ross" for "red."

The word-misformations were almost as marked in his writing words *to dictation.* Only a small percentage of the words was recognizable. He was unable to write the alphabet to dictation and he made many mistakes in writing single letters.

He could *copy* single letters or the alphabet with comparatively few errors, and he copied correctly about half of the single familiar words he was given. The others showed only slight errors and were easily recognizable.

In all forms of writing he made errors in the formation of letters as well as in the formation of words, but the greatest disturbance was in word-formation.

Six months later his spontaneous writing was not changed, except that he could write a date, though not the correct one, as well as his name. Three years after the attack he still claimed that he could not write spontaneously. Nevertheless his writing had improved by this time, for he was able to write a number of simple words to dictation correctly. Dictation tests, however, showed his performance to be under the lower limit for the literate normals. On the oral spelling test at this time he was just within the normal range. His skill in copying had improved greatly, and with the left hand he was able to copy sentences fairly accurately, although very slowly. He required a little over 9 minutes to copy the first 33 words of the test paragraph, "Every Home Needs a Garden."

Arithmetic. At first No. 21 was able to solve only the simplest *arithmetic computations,* whether presented orally or in print, and even in connection with these he often mistook the process involved, saying, for example, that "5 + 2" made "10." He was not examined again in arithmetic until three years after the attack, when his performances were much improved. He was able to do simple arithmetic computations, with only a slight confusion as to the meaning of the arithmetic symbols; his score was well within the normal range but still below the lower quartile (Stanford Achievement Computation Test). At this time he attempted printed *arithmetic problems* which he had not tried before, and had some success but the score was also within the lowest quarter of the normal scores (Stanford Achievement Reasoning Test).

Performances on language intelligence tests. The patient's difficulty in the production of words was so severe that he could do very little on language intelligence tests during the first eight months of the examination. On the *Free Association Test* of the Stanford Binet, Year X, he had great difficulty, even in comparison with aphasic patients as a group, and he produced only six words in three minutes. He made only one correct response on the *Sentence Completion Test,* that for the first sentence, and his performance was no better when the sentences were read aloud to him. He was able to define or suggest the meaning of only nine words of the *Stanford Binet Vocabulary Test* and thus fell considerably below the poorest of the normal subjects. At the same time it was evident that his understanding of word meanings was considerably greater than he could show by any of the test performances, particularly when the words were within the range of his interest. One example appeared during a conversation about the ports he had been in during the time he was a sailor. Asked what kind of a ship he had been on, he said:

> A stail . . . you know what I mean . . . tal . . . stail . . . (A sail?) No! No! (Steamboat?) Yeah, you don't call 'em a boat, you know.

Performances on all language intelligence tests were slightly higher at a second examination six months after the first. At the reexamination about three years after the attack, he fell below the lower quartiles for the normal group in the number of correct responses he gave and in speed on all the *controlled association tests*—the Oral and Printed Opposites, the Part-Whole, and the Oral Analogies. It was apparent that he was still severely handicapped in the production of words, even though his spontaneous expression was by this time more complete.

He was still unable to define enough words to reach the lower limit of the normal group on the *Stanford Binet Vocabulary Test,* but he did relatively better in relation to the normal on the Thorndike Test of Word Knowledge where he had only to choose that one of five printed words synonymous with the given word. This relationship showed again that his appreciation of word meanings was superior to his ability to express them.

Reproduction of verbal material. No. 21 could reproduce a sequence of five digits on the first examination, a fairly good performance in view of his difficulty in speaking: he could repeat only three disconnected words, however, and failed two out of three of the six to seven syllable sentences. After three readings of the short story of 82 words about the shipwrecked sailor, he could say only:

> Ship . . . wal he was doin' about some of 'em . . . I don't know what you call 'em . . . do . . . just a ship up on a bow . . . .

In spite of this great difficulty No. 21 showed that he could reproduce certain names which had been a part of his earlier experience. During the conversations about his travels he not only recognized the names suggested to him, but he produced a number which had not been mentioned by the examiner, for example, "Queenstown," "Bordeaux," "San Diego," and brought these in plausibly in the story he was attempting to tell.

About six months later when his articulation was better, he was able to repeat sentences of twelve or thirteen syllables without error, but he still got no more than five digits. Three years after the attack he could repeat six digits and six letters on auditory presentation, and five on visual presentation. At this time he was also able to reproduce series of four nonsense syllables and of four disconnected words.

NON-LANGUAGE PERFORMANCES. The patient's occupations as a sailor and a weaver suggested that he might be relatively skillful on many of the non-language tests; but, while his non-language performances were superior to the language, the majority of them fell near or below the lower quartiles for the normal group. Some but probably not the greater part of his difficulty of course depended on the enforced use of his left hand. The second examination three years after the attack showed a few poorer performances than the first, but for the most part there was improvement.

On the *formboards* of the Shorter Pintner Paterson Performance Scale, he worked fairly systematically at the first examination and the "quality" scores were always superior to the speed scores, but he did not surpass the lower quartiles for the normal group on any test. His first performance on the Seguin Board reached the lower quartile for the normals, and his accuracy in placing the blocks showed adequate form discrimination.[4]

On *Digit-Symbol Substitution Tests* he wrote the numbers in accurately but slowly, referring constantly to the key at the top of the page, and his scores were always among the poorest of the normal group (Woodworth Wells Substitution and Easy and Hard Learning Tests).

He had difficulty in *imitating complicated movements,* and on the first examination reproduced correctly only three of the patterns of the Knox Cube Test and of the Imitation Test.[5] These scores were within normal ranges but again below the lower quartiles for the normal group. On the Adaptation Test of the Pintner Paterson Performance Scale he reproduced only one of the moves correctly, a poor performance even for deteriorated cases.

---

[4] He worked systematically on the Witmer Cylinder, but so slowly that his third and best trial reached only the median for eight-year-olds.

[5] In imitating the movements of the examiner sitting opposite him in Head's Hand, Ear,

He showed less difficulty on both the *Reversed Drawing* and the *Picture Reconstruction Tests;* he seemed to manipulate the spatial arrangements here with greater ease and his scores fell at the lower quartiles for the normal group.

At the first examination he had relatively greater difficulty on *Picture Completion Tests* than on formboards, and fell considerably below the lower quartiles for the normals.[6] On the Drawing Completion Test his score was also poor, but rather because of the clumsy drawing with his left hand than because of failure to appreciate the nature of the missing part.

His own drawings of all kinds were poor, and not simply because of lack of skill in drawing. He was always able to copy or reproduce from memory simple figures such as a square, a triangle, and a diamond, but he could not reproduce either of the Designs, Stanford Binet, Year X. His drawings from a model were not good enough representations to be recognizable. The *drawing of a chair* consisted of a square intended to indicate the back, a line below to indicate the seat and two loops at each end of the line to indicate legs. In score it fell at the lower limit of the normal.

His first *drawing of a man* turned out to be some sort of animal more or less like a dog, and his second attempt made immediately afterward seemed to combine features of both animal and man. Another attempt six weeks later was a crude construction with a square head, a square trunk, and roughly outlined features; in score it fell below the lower quartile for the normal group. Still another attempt at drawing a man made three years after the attack was an equally crude representation and only a little superior in score value.

About six months after the attack, No. 21 was given the *Stenquist Mechanical Aptitudes Test* to see how ingenious he would be in assembling the various contrivances in spite of the paralysis of the right hand. His score was low, and exceeded by 93 per cent of the army men on whom the test was standardized. He was not able to devise ways of manipulating the material with one hand, and in addition he showed little understanding of the contrivances as a whole or the relationships of their parts.

No. 43. *A case of predominantly expressive disorder with marked perseveration in spoken responses. The lesion was probably an embolism of the left middle cerebral artery.*

Female, white, 44; housewife; grammar-school education; right handed.

---

and Eye Test, he not only reversed the movement in some instances, but crossed the hand to the opposite eye or ear when it should have remained on the same side, and vice versa.

[6] On the Healy II Picture Completion he made a score of only 14, equivalent in terms of the scoring for children to a mental age of 7 years and 3 months.

Psychological Summary

The disorder was predominantly expressive, but understanding, both of spoken language and of reading, was likewise seriously diminished.

The case is interesting for the progress from very limited speech in stereotyped form to more extensive speech expression, characterized, however, by poverty of words and by errors in word-formation and articulation.

The patient was emotional and cried easily. She fatigued rapidly and could work for only very short intervals, but she cooperated as well as she could.

Neurological Summary

The patient was admitted to St. Joseph's Hospital, service of Dr. Flynn, in a stuporous condition with a history of a sudden onset of unconsciousness and paralysis of the right side of the body and aphasia. Examination on admission showed that she had a conjugate deviation of the head and eyes to the left; the pupils were dilated but reacted well to light and movement. There was a well-marked flaccid right hemiplegia, with absent reflexes on this side. Examination revealed a distinct myocarditis, probably the result of an old involvement. Gradually the flaccidity diminished and spasticity developed with an increase of reflexes and Babinski, with very little return of power. It was impossible to determine whether or not there were any sensory or visual disturbances.

The psychological studies were begun one week after admission and continued over two months.

The diagnosis was undoubtedly an embolism of the left middle cerebral artery, the lesion being largely in the motor area.

Psychological Report

Speaking. At the first examination one week after the attack the patient's only *spontaneous speech* was the stereotyped expression "asapain" or "asapaint." She used this freely in answering questions, naming, etc., but was obviously dissatisfied with it. During the second week she made many more speech sounds and used a few intelligible words, but the "asapain" expression, or part of it, was mixed in with her new attempts at speech. During the next two months, the patient spoke with increasing freedom; the severe errors in word-formation and articulation decreased but did not disappear.

The patient's *reactive speech* was always more easily and more clearly articulated than her spontaneous speech. During the first week, when in trying to speak she could say only "asapain," she is reported to have said "Hear!" when the early morning singing began in the chapel nearby.

Similarly, in giving *automatic word series* the patient articulated better than in spontaneous speaking, although the series were neither accurate nor complete. Two weeks after the attack she could count up to ten or so with perhaps the omission of only one number, and she could name a few of the days of the week and the letters of the alphabet in order. The word series became more complete and increasingly better articulated during the course of the examination, but were still given very slowly at the end of the two months.

Naming. No. 43 first responded to any request to name objects by the expression "asapain." During the second week she gave some few names of common objects correctly, but articulated these poorly. Thereafter her articulation gradually improved, but for several weeks she gave only the first few responses correctly, and then repeated one name, which had been correct earlier, for all succeeding objects or colors presented her. She showed this very rapid breakdown with the ensuing perseveration in other performances as well. Aside from the errors which she made when the one word was perseverating, she did not misname objects or colors. Her difficulty was rather in word-formation and articulation than in finding the correct name.

Repeating. At first the patient was unable to repeat words or speech sounds and uttered "asapain" at every attempt. At the end of a week she was already able to repeat some single words and short, familiar phrases. The record of one of her first successful attempts is as follows:

Bye	(Good-bye)
Spite	(Good-night)
All right	(All right)
War . . er . . spegin?	(How are you?)
Spiten	(Thank you)

The expression "asapain" had already disappeared, but here, as in many other speech responses, "s" sounds entered into the misformed words very frequently. It was as if the "s" sounds were more accessible or more easily made than any others, and so contaminated many words.

Understanding spoken language. During the first week the patient could understand and follow simple commands, but failed to select to oral command about one-third of the common objects of Head's Test. Her errors in selecting objects or colors to oral command persisted throughout the first month.

After a month she responded correctly to almost all the Sensible and Absurd Test Questions (e.g. "Are papers good to eat?," "Would stones form hard beds?"). She still made many errors, however, in picking out that one of four pictures which best illustrated the phrase or sentence pronounced to her (Gates Word, Phrase, and Sentence Reading Test, given orally). Eight weeks after the attack, frequent errors were still found. They showed clearly that the patient's understanding of spoken language remained defective. Furthermore, she was still failing to follow complex oral directions which required a spatial orientation (Head's Hand, Ear, and Eye Test; Kuhlmann Comprehension, Year VIII).

Reading. One week after the attack No. 43 attempted to read some simple words aloud but was unable to pronounce any of them in a recognizable fashion. In most of her attempts the sound "s" appeared. Gradually, with improvement in speaking, she found herself able to read aloud more easily. After six weeks she could pronounce thirty or forty per cent of the words of the Gates Pronunciation Test correctly, but sometimes still perseverated with one type of mispronunciation. After eight weeks she could pronounce sixty or seventy per cent correctly.

At first she made frequent mistakes in picking out objects from the printed names shown her, and continued to do so throughout the first month. Even six weeks after the attack she made many errors in the recognition of single familiar words (Gates Word Recognition Test). Her understanding of sentence and paragraph material was likewise imperfect, and her performance on tests of reading comprehension below the level of the poorest literate adult.

WRITING. The patient's right hand was paralyzed and at no time during the examination period was she strong enough to attempt to write with the left.

Oral spelling tests were at first too difficult for her. Only in the fifth week could she begin to give any of the letters in the words, however simple these words were. By the seventh week she spelled the words aloud as well as the poorest of the normal group and by the ninth week almost as well as the median of the normal group. Thus in this performance, requiring verbal symbols but no actual language expression, she did better than in any other. Her success on some of the difficult words, such as "necessary," indicated that she retained, or rather regained, a number of learned performances. These did not, however, seem to arise in a purely automatic fashion; she could occasionally, for instance, having made an error, go over the word slowly and correct it. Several of her errors consisted of reversals in the order of two or more letters.

ARITHMETIC. During the eighth week the patient solved a few simple oral arithmetic computations. She tired very quickly, however, and then began to answer at random, with no critical attitude whatever. This response was similar to her earlier performances in naming and in reading, when after a few correct answers she began to fail regularly, usually with the perseveration of an earlier answer. Apparently simple arithmetic computations at this time were as difficult for her as naming or reading had been in the earlier, more severe stages of the disorder.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. During the eighth and ninth weeks speaking had improved sufficiently for the patient to make some attempt at language intelligence tests. She was not able to give so many "opposites" as the poorest normal, but she could indicate by gesture the significance of a few she could not name. She gave only two or three names in each class on the Jaederholm Classification Test, a very poor performance, but she did not suggest any wrong names. The responses indicated word-poverty but no misunderstanding of the nature of the class or its members.

Even at the end of the ninth week her expression was so poor that she could not give verbal definitions for more than two or three words in the Stanford Binet Vocabulary Test. She could indicate her appreciation of the meaning of more of these words by gesture or by pointing to the object.

Reproduction of verbal material. After one month, when her speech had improved sufficiently for her to attempt longer sequences, No. 43 could repeat five digits, four words, and sentences of as many as twelve or thirteen syllables correctly. After two months she was able to do slightly better, to repeat six digits, five words, and sentences of eighteen syllables.

Non-language performances. No. 43 was too weak to attempt most of the non-language tests. The Porteus Maze was given during the eighth week after the attack, when the motor performance required should have been easy enough. The patient did not follow directions, but understood the problem after a demonstration. She did less well, however, than the poorest normal, and her failure was an indication that non-language as well as language performances were disturbed.

No. 48. *A case of predominantly expressive disorder in which the language disturbances were complicated and there were in addition various general changes. The lesion was a meningeal fibroblastoma of the left frontal and parietal lobes.*

Female, white, 32; housewife; grammar-school education; right handed.

Psychological Summary

The disorder was predominantly expressive, but it was very complicated, involving many disturbances more typical of a receptive disorder and in addition the general changes described below.

The language disorders were most apparent in speaking, which was characterized by severe word-poverty, difficulty in evoking appropriate words and in naming, verbal confusions, and occasional misformed words. Writing was greatly affected but could not be studied in detail because of the patient's paralysis and weakness. Oral reading was relatively good, but both understanding of printed material and understanding of spoken language were defective. During the five weeks of observation after the second operation, the language performances showed gradual but definite improvement.

Beyond the language disorders there were more general disturbances. At first the patient had little impulse to respond in any way. She would neither call the nurse when she needed attention nor press the call-button which was put in her hand. She was, of course, very weak at this time, but her attention and interest could be aroused by visitors in the ward, by the examiner's questions and comments, etc. The lack of anything like a normal impulse to action appeared in her speech; verbal responses were always difficult to elicit, and those which were obtained were usually broken off unfinished, sometimes even in the middle of a word, as if the weak initial impulse had given out very soon.

All her responses were further characterized by considerable retardation. Not only was her speech abnormally slow, but there were appreciable intervals between questions or directions and her responses to them.

Still another characteristic of the patient's behavior was the frequent perseveration both of words or word sounds in verbal responses, and of types of performance in non-verbal responses.

Her behavior during the examinations was particularly interesting: she would make several consecutive responses correctly, and then suddenly cease to respond except by a set, rather foolish smile. At such times she was completely out of contact with the examiner for a number of seconds. After an interval or after repeated questions, she would again respond. These lapses seemed to occur irregularly; they gradually became less frequent, and had disappeared five weeks after the operation.

During the early part of the period of observation No. 48 was inclined to laugh foolishly when she had difficulty with the work. Gradually these reactions disappeared and her behavior became more natural.

Neurological Summary

At the age of 30 the symptoms began with a weakness of the right arm which was followed in 2 months by weakness in the right leg and then the whole right side gradually became paretic. Later on distinct personality changes developed, consisting chiefly of irritability and emotionalism. Then followed nausea, vomiting, some disturbance of vision, headache, tendency to drowsiness, and some staggering on walking.

Examination two years after the onset showed marked hemiparesis with increased reflexes and Babinski. Sensation on the whole right side was diminished for touch, pain, and vibratory sense and there was astereognosis. There was no history of fainting attacks or of convulsive phenomena. The patient had no aphasic disorder at this time, although it took her some time to collect her thoughts and say what she wanted to say. She had some difficulty in writing, but this was because of the motor weakness. Her memory had been failing and she was irritable and could not stand noises. According to her husband, the personality changes were quite marked and she was emotional.

Further studies at the Orthopedic Hospital showed that she had a choking of about 4D. in the right eye and 5D. in the left; the fields were concentrically contracted but more so on the temporal side and there was enlargement of the blind spots. X-rays of the skull were not conclusive. Spinal fluid pressure was very much increased but the reactions were negative. A diagnosis was made of a subcortical tumor invading the fronto-parietal area and the patient was referred to Dr. Frazier for operation.

Two weeks prior to the operation she developed uncinate attacks with olfactory hallucinations. The patient complained of a very disagreeable odor of something burning. There was no disturbance of taste. These symptoms lasted only about two weeks and did not recur. They were unaccompanied by tasting movements.

She was operated upon twice and at the first operation a large subcortical tumor in the left fronto-parietal region was exposed but not removed. The examination of the specimen indicated an astrocytoma.

Following the first operation the right hemiparesis increased and the patient had a marked aphasia. She was discharged and her speech gradually improved and the hemiparesis became less. Her aphasia, however, got suddenly worse and a second operation was performed two months after the first. At this time a large tumor, extending from the parietal lobe well into the frontal and from the cortex along to the base, was removed. The tumor was well encapsulated and the final diagnosis was a meningeal fibroblastoma.

The psychological studies were made during the month following the second operation. A year after the operation reports indicated that her personality offered fewer difficulties, her disposition and her memory being better. The aphasia had apparently become much less although we did not have the opportunity of examining her at this time. On the other hand, the right hemiplegia was complete.

Psychological Report

Speaking. During the five weeks of observation *spontaneous speech* gradually increased. At first the patient spoke only in answer to questions, and then hesitatingly, slowly, and in a fragmentary way. When she fell back into one of the lapses which has been described, she failed to answer questions at all. Gradually she began to comment on her performance, saying, for instance, "I don't know," or "I'm sunk!" Two weeks after the operation her most extensive speech response was as follows:

> (Do you talk to your husband when he comes in?) Well, you always go . . . er always have the little fellow with him . . . and I . . . (Then you don't want to talk?) Yes . . . .

From this time on she sometimes initiated a conversation herself, but her remarks were at best brief and incomplete. Sometimes even one of the words would be incomplete, with only the first of the two or three syllables pronounced. The patient sometimes said "yes" or "no" when her facial expression and gesture showed that she meant the opposite. Instances of the misuse of other words rarely appeared in spontaneous speaking for she said so little, but the difficulty did appear in the naming tests. Again because of the scarcity of speech in the early stages, no observations on grammatical structure could be made; but when speech became more extensive, there were no obvious grammatical confusions. Spontaneous speech was characterized by occasional errors in word-formation and difficulty in articulation.

Reactive speech was slightly more extensive than spontaneous speech. The patient's comments arising directly from the situation were sometimes superior to her more distinct, intentional statements.

At first No. 48, although she never initiated *automatic word series* herself, could count as far as fifteen or sixteen, and go halfway through the alphabet correctly when the first item of either series was pronounced for her. She could say the names of the days in order three weeks after the operation, and required only twelve seconds for this, but she could not complete either the series of months or the alphabet at any time during the observation.

Naming. No. 48 at first made frequent errors in naming objects, and she was not altogether accurate five weeks after the operation. She called a fountain-pen, for instance, a "pencil," and, when it was uncapped, changed the name to "inkwell." She recognized and could sometimes indicate either by verbal expression or by gesture the use of objects which she misnamed. She could almost always choose the correct name from among several suggested to her. Sometimes the names she gave, besides being misapplied, were garbled; in naming the common objects of Head's Test, after using "penknife" as a name for several objects, she then called the matches "pen-wocket." Some few names, furthermore, were badly articulated.

No. 48 was more accurate in naming colors than in naming objects; she confused only closely related colors such as purple and blue.

Repeating. A week after the operation No. 48 repeated only one or two familiar words or phrases, such as "Hello" or "Good-night." A few days later she repeated these phrases more readily and also short sentences of six or seven syllables. Her articulation was sometimes faulty, as it was even in repeating some single words. Her responses were irregular, as were all her performances at this time, because of the occasional lapses when she passed completely out of contact with the examiner. Gradually her repetition became more free and certain; the improvement paralleled that of spontaneous speech.

Understanding spoken language. A week after the operation No. 48 would usually respond to simple questions having to do with her own condition. She would show her right or her left hand, but she failed to point to her right eye, left ear, etc. In two weeks she was able to answer more than half of fifty Sensible and Absurd Questions (such as "Do apples laugh?," or "Do horses drink water?"). Her behavior indicated that she appreciated the humor of some of the absurdities. In four weeks she gave more correct answers to the fifty questions, but again asked to have a number of sentences repeated and again deteriorated toward the end of the list and gave the same response for every question.

A comparison of her relative success in understanding spoken language and printed material was made by two forms of the Gates Word, Phrase, and Sentence Reading Test, the one read to her and the other read by her. While her understanding was defective in both cases, she was considerably better able to understand the spoken words and sentences than the printed.

Reading. No. 48 at first made frequent mistakes in identifying single letters, and after five weeks still failed occasionally, even when she tried to identify the letter by saying over the alphabet. From the first, however, she could read some familiar words aloud correctly, with only occasional errors in articulation. Further tests indicated that she often pronounced correctly words or phrases which she did not understand.

Writing. The patient's first significant attempt at writing, four weeks after the operation, was very poor, even with allowance for the difficulty she experienced in using the left hand. She wrote her first name correctly but not her last, made frequent mistakes in writing familiar words, and a few mistakes in copying. Her performance did not change materially during the last week of observation.

At this time, however, she was able to spell a few words aloud, and just reached the poorest of the normal group in this performance.

Performances on language intelligence tests. Five weeks after the operation, when the patient's expression was still extremely limited and retarded, she understood the problem of the Opposites Test and was able to give the first two responses to the oral stimulus words correctly. This performance required 55 seconds. Thereafter she simply repeated the stimulus words, apparently unaware that she had lost track of the problem.

At this time she was able to define a number of the words of the Stanford Binet Vocabulary Test, although not so many as the poorest of the normal group. Occasionally she would lose track of one of these words, or at least give up trying to define it, and still perhaps succeed when the word was repeated for her. Her attitude was uncritical, and she was satisfied to define words she did not recognize, or found too difficult, in their own terms, as, for instance, "Mellow! . . . oh . . . er . . . means mellow."

Reproduction of verbal material. Ten days after the operation No. 48 could repeat three digits and sentences of six or seven syllables. At the end of five weeks, she could reproduce six or seven digits, the only language performance in which she was approximately normal. She could not, however, repeat sentences of a length anywhere near the normal.

In reproducing very short passages or statements read to her, or in recounting her own experiences, she was, even after five weeks, unable to find the necessary verbal expressions.

Non-language performances. During the whole period of observation, the patient was too weak to attempt the non-language tests, particularly since these involved the effort of using her unaccustomed left hand.

No. 51. *A case of predominantly expressive disorder with rapid recovery, following removal of an extradural clot from the left temporo-parietal region. The aphasic symptoms were more prominent than the neurological.*

Male, Negro, 28; laborer; education unknown; right handed.

Psychological Summary

The aphasia was predominantly expressive, with the most severe disturbances in speaking and writing. The patient at first could use only one or two words and several speech sounds. His articulation improved steadily and he used more and more words. His understanding of spoken language was relatively less disturbed than any other language function. Even during the first days after the attack he was always able to follow simple commands. His reading was less satisfactory, but had probably always been low grade. His writing improved during the two weeks of observation, but never reached the level of the poorest normal.

His non-language performances were poor, the only exception being the Porteus Mazes which he traced as well as the highest normals. Such a disproportionately good performance on the Mazes sometimes occurred in the normal group.

The patient was very cooperative. His general behavior on the wards was normal; he was tractable and pleasant. He was naturally disturbed by his speech difficulties and worked hard to overcome them.

Neurological Summary

This man was brought into the Philadelphia General Hospital, service of Dr. McConnell, with a fracture of the skull which involved the left temporo-parietal region. He had been struck on the head several times, apparently without being hurt, but two or three hours later he had had difficulty in speaking which gradually increased. There was no loss of consciousness at any time.

Examination the day of admission showed marked loss of power in the right lower face, deviation of the tongue to the right, weakness of the right upper extremity, which could be moved, and weakness of the right leg which was greater than the arm. The reflexes were slightly less on the right side and there was an abortive ankle clonus but no Babinski. Sensation was normal.

He was operated upon the same day; a temporal decompression was performed and an extradural clot removed with ligation of the bleeding vessel. He improved after operation.

Two days after operation he still had weakness of the right side, but the right arm and leg were distinctly better than on the first examination. The face still drooped and the tongue deviated to the right.

He was discharged practically well. No serological studies were made. Examination for aphasia was begun within three days of his accident, and continued for two weeks.

Psychological Report

This patient's progress in SPEAKING, NAMING, and REPEATING are shown in Table XXI, pages 508–509.

Understanding spoken language. Understanding was from the first much less affected than speech, although there were manifest disorders. Three days after the accident he was able to follow simple commands. He could distinguish between right and left; show parts of the body; point to the primary colors at command; and he could follow the nurse's instructions generally. In Head's Hand, Eye, and Ear Test, he had no difficulty in following the oral commands, but became confused in the imitation, although errors were of no one type. It was possible that some of this confusion was due to fatigue.

He was able to point out a triangle, square, and circle correctly to command, but in a series of interlocking geometrical figures, in which he was to point out a designated place, he succeeded in doing only one. Nine days later he succeeded in doing 12 of these, a score which was well above that of the lowest normals.

He had little difficulty throughout in comprehending the nature of the tasks which he was requested to perform.

In choosing one of four pictures to illustrate a word, phrase, or sentence, and in following directions accompanying pictures, such as "Draw a line under the big bag" (Gates Primary Reading Test, Types 2 and 3), his performance was much better for oral than for printed presentation, both forms having been given on the same day. The reading was probably within his mental and educational level.

Reading. Ten days after the operation, he read one of the simplest of the *Gray Oral Reading Paragraphs* as follows:

> "A li–i boy uh–ran away.
> He ran to the woods.
> He saw a boy–bi–bear.
> De bear . . . (was) black.
> De bear did not see mi–him.
> De boy r–r–r . . . (ran) ran home.
> She . . . (ran) . . . fast.
> He said, You . . . (I) . . . I will not ran a–a–a– (away) . . . da (meaning 'That's what I said') again." (1′ 58″)

All articulation was far from distinct, but words were recognizable. Two days later he read the same selection in 42 seconds with only 4 errors.

In a test of *silent reading* four days after the accident, he was able to choose correctly, in 15 of 35 items, one of four words to go with a picture (Gates Word Recognition Test). On the eighth and tenth days after the accident, he was able to read and understand words and phrases, and follow directions. These three performances were all on approximately the same educational level, and it is probable that this was not greatly below his normal ability.

Writing. One week after the accident when asked to write something, he attempted to write his name but succeeded in getting only the first few letters correct. He could not write "Philadelphia." It was never possible to elicit any

TABLE XXI

IMPROVEMENT IN SPEAKING, NAMING, AND REPEATING: CASE NO. 51

DAYS AFTER ACCIDENT	SPONTANEOUS SPEECH	AUTOMATIC WORD SERIES	NAMING	REPEATING
3	"No" and "No . . no . . no" only. Inflection and accent varied as in normal speech.			"Hello."
4			Colors correctly named except for blue-purple and orange-yellow confusions.	Speech sounds: could say only long "u" and long "o"; "m," "b," and vibrated "th."
6				Could repeat, explosively and with words run together: "How are you?"; "How do you do?"; "You're welcome"; (Please excuse me.) "Scu . . me . . plee . . me."
7	(What time did you get up this morning?) "About 6 o'clock. I got back . . when she came . . I just went up . . you . . twin . . bark . . . us . . so . . . ." "I read the paper. I can understand what the paper says but I scan't tells it." (Much slurring.)	"Monday . . suesday . . serday . . serday . . serday . . Friday . . Satturday . . Sunday"; * * * "debruary . . sebruary . . March . . surdril . . nodil . . thune . . dewbril . . dandid . . September . . October . . November . . . ." (interrupted); * * * "Sor . . 2 . . 3 . . 4 . . thi . . thun . . ? . . ? . . ? . . 'leben . . twelve."	(Pencil) "surpil"; (watch) "stwatch"; (wristwatch) "sirpdatch"; (chair) " 'At's a sterper"; (paper) "peper"; (coat) "soap"; (hat) "up"; (wrapper) "surper . . su . . wip . . no . . ."; (slipper) "scupper."	Could repeat many single words, but tired quickly and then made extensive errors.

further *spontaneous writing* but he was eventually able to write his name with only one error.

During the first week after the accident, he was able to write only one or two words *to dictation* correctly. Often the first letters were recognizable but the word was incomplete or ended in a scrawl. During the second week he improved and was able to write five or six words correctly. This score and that on the oral spelling test were just below the poorest of the normal scores.

He was better able to *copy* single words than to write them to dictation. He copied from print into script and made one interesting type of error, writing many of the "e's" upside down.

One week after the accident he worked for three minutes to copy seven words. A week later he copied a long selection and although he took about one and a half times as long as the slowest normal, his errors, except for the numerous badly formed letters, were fewer than those of the poorest normal.

Arithmetic. Nine and ten days after the accident he was able to do a few addition and subtraction computations. His score fell in the lowest quarter of the normal scores.

Performances on language intelligence tests. In 225 seconds he was able to give only seven of the first fourteen *opposites* of the oral list. He had no difficulty in understanding the problem and retaining the guiding principle. The score was poorer than that of any of the normals.

Most of his responses to the statements of the *Oral Absurdities Test* were incorrect interpretations, or irrelevant comments. His final score of 1 was just better than that of the poorest normal.

Reproduction of verbal material. One week after the accident, he was able to repeat three digits, but failed three letters and words. Two days later he could

TABLE XXI (*cont.*)

DAYS AFTER ACCIDENT	SPONTANEOUS SPEECH	AUTOMATIC WORD SERIES	NAMING	REPEATING
12	Speech now generally quite comprehensible, some slurring, a few extra consonants still present.	Days and months correct; "1 . . 2 . . sree . . sau . . fi . . si . . 7 . . sat . . 9 . . 10 . . 11 . . teltillne . . sirteen . . sorteen . . 15 . . six . . 17 . . sisteen . . diteen . . dunty."		Could reproduce correctly most speech sounds, except double consonants.

remember three digits, three letters, and three nonsense syllables, but failed on the words. Three days after this, he could say four digits and three letters.

One week after the accident, he could not repeat six syllables. Four days later he repeated sentences of twelve syllables with only one or two errors.

His progress was apparent on his two attempts at the short story of 82 words (Auditory Verbal Memory Test). Eight days after the accident he reproduced only the following:

> "A sail–on to baton . . . no . . . bunte . . . boies (berries?) . . . he get in a . . . no more . . ."

Three days later he was able to say a good deal more:

> "If a sailor on the ocean and . . . (15″) he first look for swater to drin' and . . . don't eat no fawd . . . water and–sen next he mus' look for sfood. (50″) Next 'ime he mus' look for a place to sleep, and next time he mus' put up a sfag to stop ship going by." (72″)

Non-language performances. His scores on *tests of imitating* complex patterns of movements, on *Digit-Symbol, Reversed Drawing,* and *Picture Reconstruction Tests* were among the poorest of the normal group. He fell below the limits of the normal group on the Drawing Completion Test.

His *drawing of a man* was better than the poorest drawing of the normal group.

In contrast to these poor non-language performances, he traced the *Porteus Maze* series without an error, obtaining a high score, which was equalled by only a few of the normals.

No. 59. *A case of predominantly expressive disorder complicated by disturbances typical of the receptive type of aphasia and by perseveration. The lesion was a subcortical cyst of the left central area.*

Female, white, 55; school-teacher, retired; high-school education; right handed.

Psychological Summary

The aphasia was severe and predominantly expressive. The disturbance was not clear-cut, however; there were difficulties in understanding as well as in speaking, and some of the verbal confusions usually found in predominantly receptive cases. In addition, there was clear difficulty in word-finding. The picture was further complicated by the effects of the patient's weakness and by her tendency to perseveration. During the three weeks of observation, the patient began to speak more readily and more completely, but showed relatively little other language improvement.

She was friendly and willing to work, but frequently unable to cooperate because of her anxiety about her condition, and her emotionalism. She fatigued very rapidly and was never asked to work longer than fifteen minutes. She required a great deal of encouragement, but, given this, she responded well. She not only understood jokes, but several times made one herself. She was well aware of her language disturbance, but not of its severity.

Neurological Summary

About six months before admission to the Graduate Hospital, service of Dr. Grant, the patient complained of a tingling in the right face. About two months later she had some weakness in the right hand and from this time on there developed a progressive weakness in the whole right side. On admission to the hospital there was a spastic right hemiplegia with increased reflexes, ankle clonus, but no Babinski. Sensory examination showed a diminution of touch, pain, and heat sensibility in the right leg only. On admission she had some difficulty in talking. Ocular examination did not show any distinct pathology although there was some blurring of the disc margins. Other tests were negative.

An operation was performed by Dr. Grant over the left fronto-temporal region. Just above the Sylvian fissure in the lower part of the motor cortex there was a vascular, yellowish area which on palpation felt cystic and from which 40 cc. of coffee-colored fluid was removed. No nubbin of tumor was found and none of the tissue was removed for biopsy. The surrounding brain looked quite normal.

Following the operation the hemiplegia remained about the same but the aphasia grew worse. The hemiplegia and aphasia improved a little during the month after operation, when the psychological studies were made. During this time the patient was very emotional and had frequent crying spells.

Four months after operation the cyst was again tapped with slight improvement in her speech, but she became progressively worse and, about three weeks later, died. No necropsy was obtained.

Psychological Report

SPEAKING. Twelve days after operation, the patient's *spontaneous speech* was slow, limited, and abbreviated. She omitted words and while she often started to express a thought naturally, she hesitated and broke off before her expression was complete. The following example was typical:

> Do you think . . . (Pointed to right hand.) . . . be cured . . . if my foot and hand . . . if they could have massage to . . . .

It was often obvious that she hesitated for words and was unable to find the correct ones. She sometimes articulated words badly, saying, for instance, "affner" for "after" or putting an "m" before the word as in "mapple," or saying "muttermilk" for "buttermilk." Occasionally she stuttered on the initial sound, as if uncertain of the word-form. She also, but less frequently, misused words. These errors were often substitutions of related words; she said "*feel* those cards" for "see those cards," and "do you mind *answering* that letter" for "opening that letter."

During the period of observation the patient's spontaneous speech improved; she spoke more readily and at greater length and hesitated less often for words.

Twelve days after the operation when tested on *automatic word series,* she was able to count to 13 or 14, but was then fatigued, out of breath, and unable to go further. A week later she said the names of the days of the week correctly but slowly. She could not start to say the series of months nor the alphabet, and could not continue with more than one or two items when the first of either series was pronounced for her. Furthermore, it was hard to start her on a new series, for after attempting to say days of the week, she continued to repeat these when asked for the months of the year and vice versa, and would persist with either days or months when the alphabet was requested. During the period of observation she did not show any more improvement in these automatic series.

NAMING. When first examined the patient named many common objects correctly. Sometimes she said the name in a poor form first and corrected it spontaneously, as "hampber . . . er . . . hammer." Sometimes she gave a garbled word, usually a contamination from an earlier response. When she failed to give a name, she was not always able to select it from several presented her orally.

In naming colors at this time she made more errors than in naming objects, for she usually gave the first few correctly and then perseverated with one of the color names which had earlier been correct. In picking out colors to oral or printed command she sometimes failed on the closely related colors "purple" and "blue." She also misread the color names occasionally.

During the next three weeks the patient was increasingly more accurate in naming objects and more likely to correct errors spontaneously. In naming colors she continued to make many errors, chiefly through perseveration.

REPEATING. Twelve days after the operation she repeated phrases and sentences of as many as seven syllables without difficulty in articulation. When she tried sentences of twelve syllables, she misformed one or more of the words.

UNDERSTANDING SPOKEN LANGUAGE. From the time of the first examination two weeks after the operation, the patient understood questions about her own condition and the immediate situation. She often failed on test questions which were no more complicated but undoubtedly more artificial to her. In general, she understood spoken language relatively well, and better than she understood printed material.

READING. When the patient first attempted to read, two weeks after the operation, she pronounced many single common words correctly. At the same time she usually understood short phrases and could pick out that one of four pictures which illustrated the phrase (Gates Word, Phrase, and Sentence Reading Test). Her errors, which were then and continued to be far more frequent than the normal, depended rather on her rapid fatigue and her tendency to perseverate than on actual inability to read.

When she had to read connected material aloud, she was less successful. For the most part she pronounced words correctly but she omitted and substituted many and was generally unable to follow the sequence of words in the text. She was not disturbed when her errors destroyed the meaning. Responses like the following illustrated the extent of her confusion:

> *The text:* There is an old stone house in my town. It is not far from my home. No other house is near it. There is a large yard and a wall around it. When it was new it was a very fine house. No one wants to live in it now.
>
> *Her reading, requiring 90 seconds:* There is an old homestead . . . homestead . . . house in my town. I lot er live in it. What too far from my home. I don't . . . I another house near to my home. I own a large house near to my home. When I not too . . . I . . . new house . . . that was not my own house . . . when too . . .

Writing. Writing could not be studied because of the patient's paralysis and weakness. She was unable to spell the simplest words aloud, and unable to spell her own name correctly.

Arithmetic. The patient could do a few very simple oral computations and problems, but she fatigued rapidly and was unlikely to answer more than the first one or two items.

Performances on language intelligence tests. The patient's language disturbances were so severe that she had little success with language intelligence tests. Once when she herself used the word "opposite" correctly, she was immediately asked to give the "opposite" of the words of the Oral Test. She gave the first and the third correctly, but then began to give synonyms or random associates or to repeat the stimulus word. When asked to name a number of objects within a class, a number of animals, for instance, she never overstepped the limits of the class but she could not produce more than three words.

She understood the meaning of a number of simple words, but could very rarely indicate it verbally.

Reproduction of verbal material. The patient could repeat only three digits or three words immediately after oral presentation. When first examined she repeated sentences of six or seven syllables but not longer ones. A week later she repeated sentences of thirteen syllables, but during the period of observation she never reproduced longer sections.

Non-language performances. The patient was too weak to attempt the non-language tests.

2. RECEPTIVE DISORDERS

No. 1. *A case of predominantly receptive disorder with severe limitation in the understanding of spoken language and printed material, confusions in naming,* *and disturbances in speaking and writing. The lesion was probably a thrombosis of the left middle cerebral artery.*

Male, Negro, 44; baggage porter for Pennsylvania Railroad; one or two years of high school; right handed.[7]

Psychological Summary

The aphasia was predominantly receptive and the difficulties in understanding spoken language or printed material were severe. The changes in speaking were relatively slight, but expression was somewhat fragmentary, disjointed, and indirect and contained occasional unusual phrases. True verbal confusions were rare in spontaneous speech. Naming was greatly affected, and the errors consisted both of garbled words and of true words incorrectly applied. Writing was more seriously affected than speaking, and contained misformed words and structural confusions which were sometimes so great as to make the product incomprehensible. The patient's work in arithmetic was particularly interesting because he had retained so many of the necessary methods and skills.

Performances on language intelligence tests suffered greatly from difficulties in expression and limitation in understanding. Non-language performances were exceedingly slow, like all the rest of the patient's work, and while they were superior to the language performances most of them did not exceed the lower quartiles for the normal group.

The patient was studied in great detail as a particularly valuable example of the complexity of the aphasic deterioration. He had had a fair education and before the attack he must certainly have been of average or above-average intelligence. He was a systematic thinker and a systematic worker. His methodical attack was clear on the various tests, notably the arithmetic tests; in drawing figures, when for example he would make the four points of a diamond and then draw the connecting lines; and in his work in the hospital kitchen and with sick patients in the wards. His case was also interesting as an example of a particularly stable condition; no changes were observed over almost three years. At the end of the study the examination was repeated again by a different examiner who found substantially the same condition, with only a few slight differences on individual tests depending on the understanding of spoken language; these probably occurred because the patient understood one examiner's speech better than the other's.

No. 1 was thoroughly cooperative. He invariably worked hard and steadily on the tests, and he worked equally well at his duties in the hospital. He was quite cheerful and friendly, although his inability to carry on a conversation prevented any normal companionship with the other patients. His pleasant manner, his willingness to lend a hand anywhere, and his trustworthiness made him universally liked around the hospital. He had a fair insight into the disorder, and could describe many of its specific characteristics.

---

[7] The patient had been secretary for a Masonic organization and claimed that he had been a 32d degree Mason.

Neurological Summary

At the age of 41 the patient, with few preliminary symptoms, suffered a right hemiplegia with aphasia; he was not unconscious. On admission to the Presbyterian Hospital he had a complete right-sided paralysis with the usual increase of reflexes and a Babinski. The pupils were irregular but reacted sluggishly. He had a definite right homonymous hemianopsia and the fundi examination showed an angiosclerosis. He was subsequently admitted to the Philadelphia General Hospital, where he remained. There was some suspicion that he might have had a tumor, but the x-ray examination was negative and spinal fluid studies showed no increase of intracranial pressure. All the chemical reactions were negative. His hemiplegia gradually lessened leaving him with a weakness in the lower face, protrusion of the tongue to the right, weakness of the arm with normal tone, but very little weakness of the leg. All the reflexes were increased and the Babinski disappeared. There were no demonstrable sensory symptoms, although these could not be definitely determined because of his aphasia. The hemianopsia remained.

His psychological studies were begun 2 years and 7 months after the onset and at this time his condition was as described above.

The diagnosis was probably thrombosis of the left middle cerebral artery, the lesion involving the central and parieto-occipital areas.

Psychological Report

SPEAKING. The patient's *spontaneous speaking* was fairly clearly articulated, with characteristics of the negro pronunciation. According to the records his speech had been less clear immediately after the attack, but he had never suffered a serious loss. During the years in which the examination was made he habitually spoke very little, not because he was unable to express himself, but because his difficulties in understanding prevented his taking part in any conversation. If he were questioned or given an opportunity to recount his former experiences, he talked at some length and enjoyed doing so.

The outstanding characteristics of his speaking were a disjointed and fragmentary form of expression, hesitancy for words with paraphrases and occasional indirect phrasing such as "most of me now is thoughtful." No. 1 did not often confuse words in speaking, but he sometimes used them in an unusual sense, and he sometimes created words, for example, "juiciful," the quality of a juicy fruit like an orange.

No changes were found during almost three years of observation and the following record may be taken as typical:

(Handed the examiner several pages which he had written about a July 4th

> celebration in St. Paul, Minn., in 1906 or 1908, and commented as follows:) One thing I could write better what's going on now . . . be best idea, but I don't read so much . . . kinda don't get the thought in . . . what writ there (Pointed to his papers.) was years ago . . . different places . . . about it . . . sumtin' I've seen before I wuz took sick . . . course I can't write very good, lak I oughta. I show you . . . sumtin in there. (Took up paper and pointed to section where he had written "On that day a general marching, music, firing ele and folks walk as I say march.") This waz . . . course you know how it is . . . people walkin' aroun' . . . music . . . firin' . . . explodin' an' things. I said here explosion . . . you know how . . . years ago people usta . . . (Do you mean a gun?) No, ma'm . . . light a match . . . (Gestured.) (Firecrackers?) Yes, I knew what it was but I can't think.

The fragmentary character of the speech and the hesitancy for words is clear in this record. At the same time there was no such general simplification or abbreviation as appears in the so-called telegram style. Actual verbal or grammatical confusions were rare enough so that the patient's meaning was almost always clear. In this respect and also in point of word-formation, his speaking was far inferior to his written expression.

Reactive speech responses did not show any differences from other forms of expression. It is noteworthy, however, that the patient's shorter comments were sometimes more normal than his longer explanations. One day when he walked into the examining room, for example, he said: "You know what I didn't do? I didn't write sumpin'. People been sick aroun' here an' I try to help 'em out."

Tested on *automatic word series* the patient was found to count correctly and easily. He could count backward from 20 to 1 perfectly and in 25 seconds (Stanford Binet, Year VIII). He could say the names of the days of the week correctly in about 5 seconds, but he sometimes hesitated in saying the months and had to start again.[8] He did not understand the word "alphabet" at first, but could say the "A, B, C's" easily. In writing them he knew where "J" and "Q" should come but was uncertain how to form these letters. The rest were correct and all were in the proper sequence.

NAMING. Some of this patient's greatest difficulties appeared on the naming tests. He could name the objects of Head's Test whether he saw them or felt them with his eyes closed, showing only about four errors or failures among the eighteen items. He made about the same number of errors in writing the names and also in selecting them to oral or printed command. He always did less well in naming colors or the Kuhlmann Line Drawings. The errors in color naming were irregular and consisted of such serious mistakes as "brown" for "green" and "purple" for "yellow." He did not realize that he had made an error when he called "red" "blue," and when blue was presented immediately afterward named it correctly. In selecting colors to oral and printed command his confusions were mostly between yellow and green.

---

[8] He was aware that he could say the series better than the individual names; he explained: S'posen you say, "What day is it?" I go "Sunny, Munny, Tuesday, Wensday, Thursday . . ." usta . . . more so. I commence "Monday, Tuesday . . ." to myself. I have to think of it before I have to say it.

The Kuhlmann Line Drawings, presenting a greater variety of objects than Head's Test, brought out his difficulties more clearly. Although he could always describe the use of the object or indicate its use by gesture, he failed to name half of the drawings of the III-Year Set and three-quarters of those of the IV-Year Set. His behavior was typical of the predominantly receptive patient. His errors consisted of a large proportion of garbled words, such as did not appear to any degree in his speaking or even in his writing, and of a smaller proportion of true words, incorrectly applied but usually related to the correct name. There were also frequent perseverations. The garbled words sometimes had a resemblance to the true names, as "head" to "bed," or "nob" to "top"; sometimes no apparent resemblance, as "guesy" to "fish." Examples of correct words wrongly used but related to the proper word in meaning or within its general sphere were: "fly" and "lice" for "butterfly," "hand" for "foot," and "hammer" for "knife." The patient sometimes recognized the correct name when it was suggested to him, but he was rarely certain of it, and he was not always able to grasp it perfectly; told the correct name for the picture of the table at which he was looking, he repeated and spelled it as "stable." He usually forgot the names he had been told within a few minutes. At the same time he apparently did learn certain words which were thereafter available for his use. The following comment is interesting: when giving a series of words in "free association," he said, "Cent, you taught me that word . . . didn' usta know it."

Repeating. No. 1 could almost always repeat single words or very short phrases correctly. His accuracy in repetition apparently depended largely on whether he had understood the word. With the less familiar words he made errors such as "authin" for "author" or "st . . st . . stirrel" for "squirrel."[9] When longer phrases were attempted, it was evident that instead of grasping a vague meaning of the whole, he usually got only one part. For instance, he gave "Are you . . . are you . . . something?" for "Are you well?," and "The dog . . ." for "The dog runs after the cat."

Understanding spoken language. The patient could almost always carry out single, easy directions such as "Point to your eye!," and he frequently followed more complicated directions such as "Cross your hands on the table!" He could give logical answers to two of the three Comprehension Questions of the Stanford Binet, Year IV. With more difficult commands or questions he was rarely successful. He carried through threefold directions such as those of the Stanford Binet, Year V, or the Marie Paper Test only a few times and his comprehension of ordinary conversation was extremely limited.

---

[9] In view of this patient's occasional difficulty in grasping words and speech sounds, a sound-recognition test was given. When a variety of sounds were made behind a screen, the patient could reproduce almost all of them either on the first attempt or after he had tried one or two good possibilities. Choosing the necessary materials from the pile of objects on the bare wood table, he produced the sounds correctly and on the first trial for the following items: by dropping on the table a sponge, an empty matchbox, a matchbox part full, a large paper clip, and a piece of heavy metal; and by pressing a snapper, running his fingers along a comb, snapping a rubber band, tapping on the table with a pencil and also with a metal box, crackling paper, and ringing a bell.

He was usually able to point to his right hand, left eye, etc., but he made the correct motion in response to only seven of the sixteen more complicated commands of Head's Hand, Ear, and Eye Test. His errors involved ear-eye as often as right-left confusions. The fact that his was a general difficulty in understanding spoken language rather than a particular difficulty in the comprehension of spatial terms was amply demonstrated when in thirteen of the sixteen trials he wrote the correct description of the movements made by the examiner facing him. His three errors were substitutions of ear for eye and vice versa; in every case he was able to tell whether the examiner's right or left hand had moved to the right or left side. This performance also indicated the extent of the receptive as opposed to the expressive disturbance.

He could not follow any of the spatial directions of the Kuhlmann Comprehension Test, Year VIII, and he pointed to the correct spot in the interlacing geometrical figures in only six of the eighteen trials of the Abelson Test. He could tell time, using either ordinary or railway nomenclature, but he could not set a clock to oral command on more than half the trials. He had better success on Head's Coin Bowl Test and placed the correct penny in the correct bowl in nine of twelve trials.

No. 1 thought that he had more difficulty in understanding spoken language than in understanding printed material. He was right in noting a difference, but it apparently depended on the fact that he could usually work over the printed material so many times. When the Gates Tests, Types II and III, were given, one form orally and the other as reading tests, no differences in ability were noted. Furthermore, an increased grasp of spoken language could sometimes be demonstrated if the material were repeated again and again in fairly short sections.

READING. No. 1 read even the simplest material very slowly, but with fairly normal phrasing and change of pitch.[10] Both his rate and accuracy scores in *oral reading* were far below the levels for the poorest of the literate normals.[11] He required 50 seconds to read the 50 words of Set I of the Gray Oral Reading Paragraphs and 200 seconds for the 150 words of Set II. His errors, aside from frequent repetitions, were chiefly substitutions of incorrect words or of badly garbled words. In comparison with the results for the normal group, he made a high percentage of such errors, and they undoubtedly reflect his confusion as to word-symbols and word-form.

---

[10] He had as much greater difficulty as the normal person in reading mirror print than ordinary print.

[11] On the Gates Tests of Visual Perception he did relatively well in finding small differences between figures and came fairly close to the normal median here, but he fell far below the normal medians in finding slight differences between number and letter sequences.

His best scores on tests of *reading comprehension* fell among the poorest of the normal scores, and he was much slower in his rate of silent reading than any of the literate normals (Chapman Unspeeded Reading-Comprehension Test and Chapman Cook Speed of Reading Tests). In his opinion he understood the first sentence but became confused when he had read one or two lines. The test results did not confirm this belief for they showed no greater difficulty in understanding paragraphs than in understanding sentences or words. For example, the patient succeeded in finding the incongruous word in the following paragraph from the Chapman Reading-Comprehension Test in two minutes' work:

> The President of the United States is guarded very carefully by police or secret service men. This is done because it is feared his friends will attempt to harm him.

Yet on the Gates Word Recognition Test, where he had to mark that one of four common words which described the accompanying picture, he failed 14 of the 48 items even when allowed an extra ten minutes to finish the test. His difficulty apparently was not in recognizing the picture but in understanding the printed word as a symbol for it. The difficulty in recognizing words of course lessened his success in paragraph reading as well, but a fair understanding of the paragraph was often possible when individual words in it were not grasped.

Writing. The patient's *spontaneous writing* was more disturbed than his speaking.[12] There were errors in the actual production of letters and "i's" were rarely dotted. There were also frequent errors in the formation of words. The main changes, however, were in the structure and coherence of the expression. Several typical examples will be quoted.

> I am s*i*ck in my head.[13] Can't walk th*i*nk wr*i*te Can't under to other as it can l*i*tte do wish things Thanks lots for the peo*p*le d*i*d.

As in this record it was often evident that the initial sentence was superior to the later ones. The patient himself realized this fact, and explained: "I don't write very much at a time . . . may write the same thing . . . have to be very careful." Actually he wrote a good deal during the three years of observation. His subject was usually some one of his experiences during the time that he had traveled around the country as a railroad porter. He was particularly interested in historic events and national figures, and many of his reports were very much like the following:

---

[12] He used his right hand altogether in writing. With his left hand he was able to write fairly legibly from left to right, but had greater difficulty writing mirror script.

[13] The letters italicized in this and the following record were misformed in the manuscript, with "i" undotted, "t" uncrossed, "m" and "p" without the final loop, "w" written like "u," and "a" like "o."

> Mr. Calvin Coolidge. he live in Nor*t*hampton Mass and seen hi*m* from th*a*t city. He *w*as in*t*erest in Boston. As he *w*as elected *i*nd*i*fferanc th*i*ngs where *i*n the town he live. He *wa*s Republican and he *w*as a a Sen*i*tor. for *i*n the Mass Cap*i*tol. I was *i*ntrested to go to the Capt*i*ol Mass. and see peo*p*le and *i*nterest see lots th*i*ng. I see Mr Calv*i*n Cool*i*dge as h*i*gh Speak taker of Man. and interest and spok low and interested. As I live in Boston I *w*as glade to see and h*i*n speak *i*n many th*i*ng. As I left Boston and live in Phildel*p*hia Pa long t*i*me few days I d*i*d not see much Mr Calv*i*n Cool*i*dge unt*i*ll a gain he *w*as made to be a lect*i*on as a Vic President

The purposiveness of the expression is readily apparent in spite of the peculiar disturbances. The product as a whole is hard to describe, but several of the most marked characteristics may be noted: errors in letter-formation and in word-formation; perseverations; unusual phrases such as "high Speak taker of Man"; errors resulting from the apparent omission of words; confusions in word-order, such as "where in the town he live" for "in the town where he lives"; and finally gross structural changes as in the clause "he was made to be a lection as a Vic President." In other passages such confusions were sometimes extensive enough to make the product incomprehensible.

Sentence dictation tests were useless in this case because of the difficulty in understanding, and even with *word dictation* tests it was necessary to have the patient repeat in order to be sure he had grasped the word. His scores were always among the poorest of those for literate normals. Even when he attempted to write the correct word he made spelling errors and grosser changes in the structure of the word similar to those in his spontaneous writing.

In *copying* his performance was slow and he made a number of errors: defects in letter-formation like those in his other written products, and in spelling. His best productions were four or five pages which he copied from the New Testament of his own accord, and his familiarity with the material may have facilitated the performance.

Arithmetic. No. 1 fell below the lower quartiles for the normal group on both printed *arithmetic computations and arithmetic problems* (Stanford Achievement Computation and Reasoning Tests). On the latter he was handicapped by difficulty in understanding, but on the former he gave relatively good performances, which were of particular interest in the study of his mental functioning because the work was carried through orally; his attack could be analyzed in detail and each part-process timed.

Four points were generally evident: first, that he worked extremely slowly, requiring from two to four times the normal time; second, that he occasionally confused the name of a process or number, without erring in the computation;

third, that he had preserved very definite habits of work, techniques such as adding the number to be carried on to the lowest number of the following column and then proceeding systematically up that column; and fourth, that when ordinary methods failed he was often able to introduce substitute methods such as adding instead of multiplying. His work with easy computations showed that he recognized the signs, or in oral work the names, for the various processes. In most cases he was able to give the answer directly, but sometimes he hesitated, saying "I donno that." Sometimes the correct answer came to him after an interval. For example:

> Five sevens . . . lessee . . . five sevens . . . (15″) five sevens . . . thirty-five . . . I almos' forgot that . . . five sevens . . . thirty-five . . . yep . . . five sevens . . . thirty-five . . . (70″)

Sometimes when he made an error, he was apparently uncertain about it, and when in the course of five or ten examples he happened on a related computation, he would then immediately go back and correct the error. For instance, in doing the Woody Multiplication Scale A, he answered question 4,

$$4 \times 8 =$$

as 24. When he came to question 9,

$$\begin{array}{r} 254 \\ \underline{6} \end{array}$$

he said, "Six fours is . . ."; immediately he went back to question 4 and said: "Four times eight . . . wrong then . . . six fours . . . fours times eight . . . mus' be sumtin' lak thirty-two . . . six fours is twenty-four . . ." (etc.). Such instances were significant as demonstrations of the fact that specific formulations like "four times eight" and the questions connected with them could be kept in mind during the course of other arithmetical work and referred to immediately when a contradiction arose.

Analysis of the more complicated computations showed that No. 1 was still able to carry and borrow numbers, and apparently to do so mechanically without particular thought. He could also solve computations involving fractions and decimal points without particular difficulty.[14] He could read numbers correctly through the seventh place. All these facts on the positive side are of great importance for they show how well arithmetical habits and processes of thought were preserved in spite of fairly severe aphasia. It has already been stated that the patient fell below the lower quartile for the normals on arithmetic computations, and there can be no doubt that he would have done far better before the attack. A few of his errors might possibly have depended on the hemianopsia for he occasionally skipped a column in doing long additions or subtractions. The majority of them, however, resulted from insufficient knowledge of tables.[15] This difficulty may be regarded as a definite part of the deterioration, and so too were the occasional errors which resulted from defects in reading numbers. In short, analysis of his work in arithmetic showed a fundamentally high type of performance, with many of the more complicated processes retained, but a marked deterioration manifested both in the slowness of work and in the abnormally high proportion of errors in number combinations.

---

[14] On the first arithmetic test when he came to the first computation with a decimal point, he immediately said, "I almos' forgot . . . firs' time I've seen that since I been sick," and placed the decimal point in the answer correctly.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. Studies of language intelligence were not particularly interesting. For the most part they reflected the great difficulties in understanding and reading on the one hand and the confusions in expression on the other. The patient could understand the problem of the *Opposites Test,* but he could not give more than three or four correct responses out of twenty on either oral or printed list. He required about 5 minutes for the twenty words, but part of his slowness depended on the fact that several of the words sometimes had to be repeated two or three times before he could grasp them. His errors were always true words. They were sometimes related to the stimulus word, as "health" to "sick," but they often had no evident relation as "from out" in response to "big" or "often" in response to "above." His grasp was too slight for him to attempt the Oral Analogies Test, but he gave no correct responses on the Printed Analogies. When the latter was made into a "multiple choice" test, however, he could select the correct response from among the three given words in almost every instance.

The Free Association Test of the Stanford Binet Scale showed a very poor response from the point of view of quantity, for he averaged about 22 words. It was interesting to find, however, that he gave most of the words in groups; that is, he had a relatively superior method of response. For example, he would say four or five names of animals or of foods, or he would give some less coherent group such as "President, Governor, army, navy." The responses showed clearly: first, that he had and used naturally some concept of classes of objects and, second, that the words which came to his mind in "free association" were not limited to the simplest and most familiar words. His concept of a category was interestingly demonstrated on the Jaederholm Classification Test, where it seemed that the introduction of terms belonging to more than one category or his verbal confusion led him into errors which he hastily corrected because of his understanding of the objects as members of a particular class. Asked to say as many names of animals as possible, he responded as follows:

> Let's see . . . dog . . . sheep . . . en' . . . hawgs an' cattle an' turk . . . turkeys . . . an' cheese. Ah's gonna say cheese, but that's different; that's sumtin' to eat (60 seconds). Did I say . . . girls . . . Ah mean . . . not girls, but cat . . . 'at's what I gonna say. Used to know everything, but now . . . what's the other one? Fox, did I say fox? An' horse, did I say horse?

---

[15] The Buswell and John Diagnostic Chart for Difficulties in Fundamental Processes in Arithmetic was used in addition to the usual tests.

In view of the confusions in expression, it seemed natural for scores on the *Sentence Completion Test* to be low. On repeated examinations they always fell at about the lower limit for the normal group. In comparison to the normal, the errors were irregular; that is, the patient often failed to complete a simple sentence correctly when he succeeded with a more difficult one. On the first examination, for example, the relatively easy sentence, "I *try* to school each day," was wrong while the more difficult sentence, "Boys and *girls* soon become *men* and women," was right.

No. 1 had very little success in constructing words from given letters, and he experienced just as much difficulty with block letters which he could move around at will as with a series of printed letters. Given "A E I R L P," he wrote the word "ail" in five minutes; in the next ten minutes he wrote "earl, ilape, riplea, sapril, and pulrac." He was uncertain as to whether or not these were actually words, and could be convinced either one way or the other about any of them.

He did not do well on the test of constructing sentences from the given words: "and," "are," "been," "cities," "do," "go," "have," "his," "in," "is," "men," "the," "to," "where," "work." His productions were much like those of his spontaneous writing. For example, his first three sentences on the first attempt were:

Final sentence	*Time*	*Comment*
1. to go in the city	3′ 45″	To go in the city lady, but I don' see . . . boy or sumtin' lak that I could put on this end.
2. to work in men	4′ 00″	
3. been do go in the cities where work men	7′ 00″	I wanna get some more . . been do go in the cities where work men . . . in the city, I was gonna say . . . sumtin' lak that . . . in the town, but I ain't got enough.

The experiment was interesting as a demonstration of his great confusion with regard to sentence structure, but the detailed analysis of the steps by which he formed the sentence did not show anything further about the exact nature of his difficulties. It was clear, however, that his work was a purposive attempt to carry out a definite idea.

On the Stanford Binet *Vocabulary Test* No. 1 could show his recognition of the meaning of only about ten words. On the Thorndike Test of Word Knowledge he chose the synonym for the test word only four or five times. Apparently he was not so successful with this as with the "multiple choice" form of the Printed Analogies because the vocabulary test involved a greater number of possibilities. It was obvious that his vocabulary was limited as a result of the aphasia, but at the same time it was not so limited as the tests would indicate. His speech and writing showed that he had some service of a large number of words, which could not be estimated by the tests because of the limitations in the understanding of spoken language and printed material.

Reproduction of verbal material. No. 1 could repeat only three digits, two letters, three nonsense syllables, or two disconnected words after oral presentation, undoubtedly because of his difficulties in reception. He could reproduce five digits or five letters after visual presentation. He could repeat some very simple sentences of as much as six syllables, but failed about two-thirds of the six or seven syllable sentences. The short story of 82 words about the shipwrecked sailor was interesting rather as an index of his grasp of spoken language than of his ability to repeat (Auditory Verbal Memory Test). After three readings he reported as follows:

> I think it's people . . . person . . . was going to another place where he on water . . . guess he got lost . . . person was not to eat . . . say maybe . . . fur de sickness . . . that they should take some water . . . take it out . . . on account of maybe sickness . . . Other people was taken . . . er, was from the place where they travel on the water, and I think they wuz taken . . . somethin' lak that.

There were many indications on the one hand that No. 1 had great difficulty in remembering names. For example, he could describe the position he had held in his section of the Masonic organization by saying "write letters," but he could never produce the word "secretary." On the other hand he produced a number of names and facts expressed in verbal terms which had been a part of his earlier experience. As a railroad porter he had traveled to many cities, and he could recall the names and even some of the streets of a number of these. When writing about Washington he used the letters "N.W." and explained that these meant "north west." An example of his interest in national figures has been given in the section on his writing. He was able to recall scattered facts about Washington, Grant (for whom he had been named), Taft and the Taft boys, Harding, and Coolidge. His "mental content" as suggested roughly by his many conversations was an excellent example of the complexity of the aphasic deterioration. It was never possible to say that he showed a "loss of memory" for verbal material, for names, for recent events, or to fit him into any simple category. His mind naturally turned to the subjects which had previously interested him. In connection with these he seemed to have preserved a sort of general framework so that his attitude toward persons and events was much the same as before and so that he had enough appreciation of the actual facts to enable him to reject gross incongruities. In addition to the general framework he was able to produce certain facts, completely or in parts such as half a date or the location of a street without its name.

Non-language performances. In comparison to those of the normal group, the non-language performances fell at a much higher level from the point of view of quality than from the point of view of speed. The patient's activity was not handicapped by paralysis; at the time of the examination he used the right as well as the left hand skillfully, and was accustomed to use both for tests such as the formboards. It is probable that the right homonymous hemianopsia interfered with his perception of the materials of the tests and so contributed to his slowness. The defect in the visual field is not a sufficient explanation, however, for his language responses on oral as well as on printed tests were slow. In an attempt to determine whether very simple responses were also retarded, a reaction time study was made. By means of the Marietta Reaction Time Apparatus four series of 35 reactions and a fifth series of 50 reactions were taken with an interval of a week between each series. The stimulus was auditory, a buzzing sound. In order to make the results comparable to those obtained from patients with right hemiplegia, the patient pressed the key with the left forefinger. The results were not altogether satisfactory for he did not understand well enough to attempt to give either a definite motor or sensory reaction. His average time for the last four series, 155 reactions in all, was 200.48 sigma with a standard deviation of 37.22. This sigma is higher for a "motor" and a little lower for a "sensory" reaction than the normal. It is considerably higher, however, than the averages obtained for any of the hemiplegic patients or normal persons tested on the same apparatus and given the same directions; the only higher sigmas were obtained from two patients with multiple sclerosis. It seems likely, therefore, that the patient was retarded in simple as well as complex reactions.

His scores on the *formboards* of the Shorter Pintner Performance Scale which are scored separately for rate and for the number of moves or errors were particularly interesting; the rate scores indicated a performance at or below the lower quartiles for the normal group whereas the "quality" scores placed him at the upper quartiles. His speed on the Seguin Board was just about that of the slowest normals.[16]

He worked very slowly on all the *Digit-Symbol Substitution Tests,* falling just below the poorest of the normals on the Woodworth Wells Substitution Test and just above the poorest on the Easy and Hard Learning Tests.

In *imitating complex movements,* when speed was not a factor, he did relatively well, falling near the normal medians on both the Knox Cube and the Imitation Test. His comparative skill in such performances was again apparent on Head's Hand, Ear, and Eye Test where he imitated all but one of the movements made by the examiner sitting opposite him—a very good performance.

He understood the problem of both Reversed Drawing and Picture Reconstruction Tests of the Pintner Non-Language Scale; his scores on the former were a little below the lower quartile for the normals, on the latter a little below the median.[17]

---

[16] He was also very slow on the Witmer Cylinder Test, with the times for the three successive trials 185, 140, and 135 seconds. The median six-year-old child fails but the median seven-year-old is supposed to pass in 76 seconds.

[17] It is interesting to note in connection with these tests, which probably require either visual or logical reconstruction, that No. 1 passed the Induction Test of the Stanford Binet,

On the *Picture Completion Test,* where speed in work is relatively unimportant in the score, he almost reached the normal median, showing that he could understand picture situations fairly well. On the Drawing Completion Test, however, he did much less well and even when the time limit was extended to three times the normal, his score did not reach the lower quartile for the normals. He was apparently unable to analyze many of the drawings sufficiently to determine the missing part.

He was able to copy simple geometrical figures accurately and to reproduce them from memory after a short exposure. He succeeded in reproducing one of the Stanford Binet Designs, Year X, correctly and one sufficiently well for a half credit.

In *drawing a chair from a model* he made a score a little below the lower quartile for the normal group. The drawing was recognizable as a chair, with a back, a seat, and three legs, but the perspective was wrong and only two dimensions were indicated.

His *drawing of a man* was a crude, incomplete figure with very bad proportions and merited a score slightly above the lower quartile for the normal drawings.

No. 1 did relatively well in tracing the *Porteus Mazes,* an interesting finding in view of the right homonymous hemianopsia. His score surpassed the lower quartile for the normals. He worked slowly and with great care, and his errors apparently did not depend on lack of "foresight," but on a faulty visual analysis of the maze.

He was given the *Stenquist Mechanical Aptitudes Test* and was perfectly able to use both hands in assembling the various contrivances. He was interested and worked hard, but his score was excelled by 67 per cent of the army men on whom the test was standardized.

No. 35. *A case of predominantly receptive disorder with severe disturbances in speaking and writing, resulting from trauma. The aphasic symptoms were more marked than the neurological.*

Male, white, 28; research engineer; college graduate; right handed.

Psychological Summary

The aphasia was predominantly receptive, but disturbances in expressive processes were also severe. In the pre-operative period the disorder was slight and would have been impossible to classify as of any particular type, at least without better descriptions of the more severe speech disturbances immediately

Year XIV. For the latter his solution was definitely verbal; after the second folding he murmured "Twice" and at the end when questioned as to how one could determine how many holes would be in the paper after each successive folding, he explained: "Double it, twice de nomber."

after the trauma. Examinations showed, however, that the patient made abnormal errors in speaking and writing, and on the Sentence Completion Test fell considerably below the levels which would be expected for a man of his superior education and ability.

On the day of the operation when the patient regained consciousness, he was able to give several short but clear and coherent answers to questions. The next day, after a series of convulsions, speech responses were almost entirely lacking and the patient obviously could not grasp most of what he heard. Examinations begun the next day, the second after operation, showed that he produced a number of speech sounds in an attempt to answer questions, but no words were recognizable. Furthermore, most of his responses indicated that he did not understand spoken words.

Further examinations showed improvement in speaking, with longer and more complete expressions, less blocking in propositional statements and fewer errors in articulation. The difficulty in understanding spoken language was extremely severe, but decreased fairly rapidly during the four weeks of observation. Understanding of spoken language was always inferior to reading comprehension, and was still clearly limited four weeks after operation. At first the patient found himself able to write a number of words which he could not produce in speaking, but the superiority of the written expression was only in the production of words. When he attempted to write sentences, he made gross structural and grammatical errors. Furthermore, his writing was disturbed by letter errors comparable to the articulatory defects of speaking, and by verbal confusions. On the whole, the usual expressive defects of the predominantly receptive disorder were much more marked in this patient's writing than in his speech.

Extensive non-language tests were never made, but it seemed evident that non-language performances were little affected in comparison to the severe language disturbances.

The patient cooperated well. He was able to work steadily and apparently without fatigue, but shortly after the operation he was asked to work for only fifteen or twenty minutes a day. Even when his difficulty in understanding spoken language was most severe, he grasped the problems of the various tests easily, picking up cues from gesture and other parts of the situation. His insight into the disorder was greater than that of the average aphasic patient, but at the same time he did not appreciate its severity.

Neurological Summary

Three months before observation the patient injured the left side of the head in an automobile accident. The scalp was not cut, and he was dazed only a little. There resulted a depression of the skull about the size of the end of the index finger, about a half inch above the left ear. For a day or two following the injury he was nauseated and had some projectile vomiting, and for a week a sensation of a lump in his throat. For the first ten days he had difficulty in swallowing and this became less and finally disappeared. At the same time he had drooling on the right side of the face, which was somewhat flat, but his tongue was normal.

When first examined in the Graduate Hospital three months after the injury the only neurological symptoms consisted of a minor drooping of the lower right face and a lagging of the right palate on phonation. Ophthalmoscopic examination was entirely negative.

Immediately after the injury there was considerable disturbance in his speech which gradually lessened. When he was first examined, while his aphasia was very slight, nevertheless it was unmistakable and served as a better indication of the degree of brain injury than the neurological symptoms. Because of it and the presence of the depression, which was clearly shown by the x-ray, it was thought advisable to explore the brain and remove any possible scars which had developed. Dr. Grant exposed the central area and found underneath the depressed bone which was removed "the most perfectly localized scar in what I take to be Broca's area that I have ever seen. The scar was 1½ cm. across in either diameter and seemed to be strictly localized to the cortex. On palpation it seemed so superficial, scarcely more than 2 mm. deep, that excision seemed inadvisable. There was no palpable scar tissue, just a surface destruction." The damage to the brain was anywhere from the size of a five-cent piece to a quarter and extended inwards to what could be regarded as the second lamina of the cortex. Unfortunately, however, in freeing the adherent dura and some adhesion which had developed between the dura and the cortex a number of vessels had to be clipped, thus interfering with the blood supply of the cortex and causing the symptoms to be described.

Following the operation the patient had a stormy time for a few days. He had a whole series of Jacksonian convulsions limited to the right face, arm, and leg, with distinct weakness on the right side, mostly in the face and arm, and a very marked aphasia. The convulsions ceased in a few days and the paresis also diminished and on his discharge from the hospital, about three weeks after his admission, there was little remaining weakness in the lower right face and arm. He also had some disturbance of sensibility in the right face and arm but because of the aphasia it was impossible to determine its extent in the beginning. His aphasia remained about the same for the first week, and then rapidly grew better, at which time it was possible to demonstrate some astereognosis and sensory disturbances in the right hand and arm of an indefinite character. When he went home about five weeks after the operation he still had a little weakness in the lower right face. It was difficult to determine that he had any weakness in his arm. The sensory symptoms were negligible.

This was a very interesting case for while the neurological symptoms were very meager the aphasic symptoms were profound. This was evident immediately after the accident, and again after the operation the aphasic symptoms were much more marked than the neurological.

The lesion undoubtedly affected not only the middle and lower portion of the pre-central convolution but also the parietal convolutions.

Psychological Report: Pre-operative Condition

SPEAKING. According to the history the patient's speech was seriously disturbed immediately after the accident. He had difficulty in "getting anything out" and later, when he began to speak more, misused words occasionally. Although the speech had improved considerably after about ten days, there was little further progress; and at the time of the first examination, three months after the accident, the patient still complained of misusing words, of asking for "luggage" instead of "Luckies," for example, or of saying "east" for "west."

During the examination, however, no such verbal confusions appeared and the only abnormalities noted were a slight and occasional hesitancy in speaking and a word or two indistinctly articulated.

NAMING. The patient named familiar objects and colors without error or hesitation.

REPEATING. He repeated single words and short phrases accurately, but made occasional errors in articulation when he attempted longer sections.

READING. In *oral reading* No. 35 was slightly superior to the median of the normal group. From his hesitancy and mispronunciation it was evident, however, that his reading was somewhat disturbed; his performance was considerably inferior to that normal for a man of his ability and education.

In his *understanding of printed material* he fell a little above the upper quartile of the normal group, but again his performance was not what would be expected of a college graduate of his standing (Chapman Unspeeded Reading-Comprehension Test).

WRITING. *Spontaneous writing* was coherent and apparently normal in structure, but spelling errors were sufficiently frequent and unusual to indicate a breakdown in the writing process.

In *writing to dictation* the patient exceeded the median of the normal group, but again probably did not reach his original level.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. A test of *controlled association* placed the patient near the highest of the normal group (Oral Analogies Test). His performance here was not perfect but would certainly have given no proof of disturbance in mental functioning. On the *Sentence Completion Test,* where blanks in each sentence must be filled in so that the whole is coherent, the patient's performance fell slightly below the normal median. It was consequently far below the level which he should have attained. He understood the problem but apparently had difficulty both in producing words as possible solutions and in judging the quality of his responses.

Reproduction of verbal material. No. 35 was able to repeat only six digits, six letters, and five disconnected words and thus fell slightly below the normal and considerably below his probable level in the immediate reproduction of verbal material.

Non-language performances. Since time was limited, most non-language tests were omitted. Enough drawing tests were given, however, to show that the patient was more than usually skilled in this line. He had had, of course, a good deal of experience in mechanical drawing. His drawing of a chair from a model was practically perfect, with accurate proportions and details and good perspective. The lines were somewhat rough and he intended to smooth them, but lack of time prevented. His drawing of a man, which was rapidly and easily done, surpassed the median of the normal group in score (Goodenough Scale). He could undoubtedly have done better had he made a greater effort.

Psychological Report: Post-operative Condition

Speaking. On the day of the operation when the patient regained consciousness, he naturally spoke little but the phrases he produced in answer to questions were said to have been clear and accurate. On examination two days later, after a series of convulsions, his *spontaneous speech* had deteriorated: he was reluctant to make any attempt, produced very few recognizable words and for the most part uttered a jumble of speech sounds in which "s" and "z" predominated.

Progress in speaking was at first slow. When the patient made any definite, voluntary effort to answer a question or make a statement, his production was scanty and the words were so garbled as to be mostly unrecognizable. Gradually after the first few days, however, he began to make comments on his difficulties or on some part of the situation. He would often start these expressions easily, and would then hesitate and be unable to complete them. After having difficulty in reading, for example, he said: "Funny I can't . . . then . . . if you . . . then . . . en . . . ." Although they were often incomplete, these spontaneous comments or expressions in reaction to some immediate situation were notable in contrast to the more voluntary statements for their ease and accuracy of articulation.

By the end of the second week, short expressions such as "I'm not tired," "I was asleep," or "That's all right," were becoming frequent, and the patient would attempt longer statements. These were fairly well articulated but still fragmentary. For example, when asked if he were going up on the roof, he said: "Well, probably in the afternoon . . . I guess . . ."; shook his head to indicate that he did not want to go, and then continued: "You have to have a hat . . . it's . . . hot."

During the third week after operation the patient's speech became more extensive. In the longer products, however, several abnormalities were noticeable. The expression continued to be fragmentary, with breaks when he could not express his thought. Defects in articulation were to be observed: some words were slurred and in others there were actual letter substitutions. A second type of error appeared in his occasional verbal confusions, some of which were corrected spontaneously. The progress in speech continued during the next ten days, but hesitancy and errors were still present at the last examination, and the patient still complained that he sometimes had difficulty "thinking of the right word."

Automatic word series were generally superior from the point of view of articulation to the patient's voluntary statements but not to his more automatic comments. Two and again four days after operation, he could not count by himself, but on the fourth day he approximated a few word-sounds in counting with the examiner. Ten days after operation he required about 25 seconds to count to 15 or 20, and was able to get that far only if he were prompted on several numbers by being shown the lip, teeth, and tongue position for the initial sound. At this time in an attempt to say the names of the days of the week, he repeated "Monday" correctly, and failed to do better with the series than "Stunday . . . Study . . . Thursday . . . Thurdy . . ."

Naming. Two days after operation, the patient's attempts to name objects all resulted in monosyllables such as "zur," "zom," "zo." Once or twice he spontaneously indicated the use of the object by gesture, but he could not understand requests to do so. Two days later he was still unable to give any names aloud, but he wrote several. Some of these, such as "cown" for "comb" were badly misformed.

During the second week after operation he named about half of the familiar objects of any list correctly. His errors were garbled words having no apparent relation to the true names, and tending to show perseveration within any day's trial. During the third week he named common objects correctly, and made only one error in naming the colors of Head's Test.

Repeating. On the second post-operative day No. 35 could not repeat any words. He then gradually became able to repeat words and familiar phrases such as "Good-morning," "What is it?," etc. Ten days after operation he sometimes still failed completely with a relatively simple phrase. At the same time it was noticeable that he often repeated parts of the directions given him when he did not understand them. Just as his spontaneous "reactive" comments were superior to the voluntary statements which he attempted, so, in repeating, the phrases which arose as a part of a whole situation were more easily and accurately produced than those where the effort was on the repetition, and that alone.

By the end of the second week words and short phrases were repeated practically without error, but defects in articulation were still frequent in longer sections.

Understanding spoken language. When the first examination was made two days after operation, it was immediately evident that the patient understood almost nothing of the spoken language he heard. At the same time he quickly followed clues from gesture or other parts of the situation. Later in response to questions about this period No. 35 said: "At first I couldn't (understand), but I knew everything what was going on. I could think all right."

Examinations made on the ninth and tenth post-operative days showed that he had much more difficulty selecting the correct one of four pictures to illustrate a spoken phrase or sentence than to illustrate a printed one (Gates Word, Phrase, and Sentence Reading, one form given as a reading test and one read aloud to the patient). Even with two repetitions the responses to sentences he heard were not so accurate as to those he read.

While the difficulty in understanding was severe, it diminished fairly rapidly.

TABLE XXII

PROGRESS IN ORAL READING: CASE NO. 35

DAYS AFTER ATTACK	GRAY ORAL READING PARAGRAPHS (Sets increase in difficulty from I through III)						GATES PRONUNCIATION TEST
	SET I (50 WORDS)		SET II (150 WORDS)		SET III (150 WORDS)		(100 WORDS)
	Time	*Errors*	*Time*	*Errors*	*Time*	*Errors*	*Words correct*
9							2
13	125″	16					13
14	78″	16					
18	34″	5					
21			101″	8			
25					104″	7	
31					94″	5	

Three weeks after operation, the patient could follow all the Abelson Directions, pointing to the correct places in the interlocking geometrical figures. His understanding was still far from normal, however; he became confused when he attempted to follow long or complex conversations or to listen to persons whose voices he did not know well. Furthermore, he still made a few mistakes in recognizing simple words, particularly if they were isolated from any context.

READING. *Oral reading* followed approximately the same course as speaking. Until the end of the second week, letters and words were usually confused or so badly pronounced as to be unrecognizable. There was also a good deal of perseveration in the garbled word forms. The improvement in oral reading appears in Table XXII.

Even on the thirty-first day, the last day of observation, the patient's oral reading was still seriously affected and his scores fell among the poorest quarter of those of the normal group.

It has already been stated that the patient was relatively more successful in *understanding printed material* than spoken language. In both processes he was far below the normal. One month after operation he had improved so that he reached the median of the normal group on a reading comprehension test, but he had exceeded the upper quartile of the normal group on the same test before operation (Chapman Unspeeded Reading-Comprehension Test). He still complained that newspapers were too badly written to be comprehensible and that he could not yet attempt to read books.

WRITING. *Spontaneous writing* was at first a little more extensive than spontaneous speech. Two days after operation the words which he wrote were no less garbled than those he attempted to say, but two days later he was able to write his own name and the names of several objects while his speaking was still incomprehensible. After this, however, when he began to attempt connected sentences, it was apparent that his written expression was inferior to his speaking. It was disturbed by misformed letters, by verbal omissions and confusions and, most severely, by gross structural and grammatical defects. Repeated observations revealed steady improvement, which was not, however, sufficient to bring the writing up to the pre-operative level or even to make it comparable in quality to his speaking (Table XXIII, page 534).

On the fourth post-operative day the patient was able to *write to dictation* only one or two single letters or single words. Thereafter many word dictation tests were given with increasingly satisfactory results. The errors were largely of two kinds: gross difficulties in spelling words which he had recognized as they were dictated, and confusions in grasping the dictated word. One month after operation the patient's score in word dictation was still below the lower quartile of the normal group (Morrison McCall Spelling Scale).

During the first few days after operation the patient made occasional errors in *copying* single words from print, confusing, for example, the letters "b" and "d." During the third week errors were still present in copying connected text, and the rate of copying was only about half the normal.

ARITHMETIC. Arithmetic tests were among those which had to be neglected in this case because the disorder was changing rapidly and time was limited. A test of *arithmetic computation* during the fourth week, however, showed that No. 35 was even then above the normal median (Stanford Achievement Computation Test). Simple arithmetic processes were, in other words, much less affected than reading or the understanding of spoken language, writing, spelling, and so on. At the same time the patient's performance on the computations was considerably below his probable original level.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. Understanding and means of expression were too limited during the weeks immediately after the opera-

TABLE XXIII

PROGRESS IN SPONTANEOUS WRITING: CASE NO. 35

DAYS AFTER OPERATION	WRITTEN PRODUCT	COMMENTS
2	Tar rel Thevad	
4	Eat prench	Name written correctly.
10	We was and readings	Name and address written correctly.
14	Dr C —— I am may would not give to go very a week. Very worries ~~v vi v~~ will s	
18	Dear P —— I very give you letter today. The news very ~~in~~ insh	When questioned, the patient said that the first sentence of this letter is meant to be: "I got your letter today."
21	Dear P ——, Today is a very good day but is a little bit too hot for farfect. I am no know better than a week ago wlen I am going home	When questioned, the patient said: "I mean I don't know any better now when I was going home than I did a week ago."
24	Dear H ——, You were fine to come down and me a visit. Today is the first time I had about wlen I went going home. It were probally gone home the next week. Tley thot I would better home by train. I think it will ~~best~~ most easy also.	
31	Dear P ——, At last I believe I am going home. It is go to be tomorrow. When we home we expect to move up to camp as possible. I will like it too be I will get some swimming.	

tion for the patient to attempt language intelligence tests. During the fourth week, however, he reached the normal median in the number of correct responses on the Oral Opposites Test but fell far below the normal in the rate of producing them.

Reproduction of verbal material. The amount of material No. 35 could repeat was naturally limited by his difficulties in grasping words on the one hand and by his difficulties in articulating on the other. Four weeks after operation he was still unable to repeat sections as long as those he had repeated before operation.

Non-language performances. Partly because of the patient's weakness and partly because of lack of time, non-language tests were omitted. During the second week after operation, however, the patient was asked to draw a picture of a man to compare with the one he had drawn pre-operatively. The new drawing was more carefully made than the earlier one, but merited about the same score (Goodenough Scale).

No. 56. *A case of predominantly receptive disorder in which repetition was superior to the understanding of spoken language. The lesion was probably a thrombosis of the left middle cerebral artery.*

Male, Negro, 45; barber; education unknown; right handed.

Psychological Summary

The aphasia was severe and predominantly receptive. Spontaneous speech was limited and repetitious; there were marked difficulties in evoking words and in naming. The patient understood very little of what he heard and could not follow simple commands. Nevertheless, he was able to repeat sentences as long or longer than those he failed to understand. He could not read at all nor could he identify block letters, nor write. On the whole he was below the poorest of the normals in arithmetic.

On non-language tests, he occasionally did well enough to fall within the normal ranges. In general his non-language performances were slightly but never markedly superior to his language.

The patient cooperated as well as he could but frequently had such difficulty grasping the problem that he became discouraged. He responded well to encouragement and persuasion but fatigued rapidly. He was friendly and usually cheerful.

Neurological Summary

The history is not clear because it was impossible to obtain it from the patient on account of the aphasia, but he was able to work until about four months prior to the onset when he was supposed to have had a temporary disturbance of vision presumably because of a hypertension. There was an indefinite history of headache with a hemiplegia on the right side. When examined in the Pennsylvania Hospital about four months after the beginning of the symptomatology there was a definite right hemiplegia in which the weakness in the face and arm, while slight, was more definite than that of the leg. The limbs on this side were at first flaccid and while the reflexes were present there was no ankle clonus or Babinski. All the serological tests were negative.

In all probability the patient had a hypertension resulting in thrombosis of the left middle cerebral artery.

Psychological Report

Speaking. *Spontaneous speech* was limited to a few more or less stereotyped sentences, such as:

> I am trying to tell you now; it looks like I can tell you, but something . . . I want to tell you but I don't tell you what it is. I am just trying to tell you now, but I can't tell you.

The perseveration seemed to indicate less an inability to produce other words or phrases than extreme limitation in spontaneous mental activity.

There were no instances of verbal or grammatical confusions within the limits of this restricted speech.

Automatic word series were relatively superior to spontaneous speaking. No. 56 could count correctly by ones, twos, and fives, and say the names of the days of the week in three seconds. In naming months, he stopped at "September" and could not go on until "October" was supplied, whereupon he finished correctly. He gave the first half of the alphabet well, but confused the letters of the second badly. He was unable to repeat a poem which his wife said he knew and started for him.

Naming. No. 56 showed a great disturbance in naming. The objects of Head's Test presented so difficult a task that he had no success at all. Although he apparently recognized the objects represented in the line drawings of the Kuhlmann Pictures, he was unable to name them. He could not identify the name for a given object among several names suggested to him orally, nor could he recall the name several seconds after it had been told him. He could sometimes indicate the use of the object and even express it verbally. Shown a picture of a comb and asked "What do you use it for?," he replied promptly with appropriate gestures, "I can comb my hair." He named colors incorrectly or said, "I know but I can't say," but he matched them with only one error. He could not point them out correctly to oral commands. Block letters he could not name from sight or touch. His wife said he frequently forgot her name, and called her almost anything; he could not always recall his own name.

Repeating. He could repeat words and short phrases without difficulty in articulation.

Understanding spoken language. No. 56 was extremely limited in his understanding of spoken language. He was wrong in 22 of the series of 50 Sensible and Absurd Questions. There was a marked tendency to perseveration. He could understand some of the easier Stanford Binet Comprehension Questions but was very inconsistent in his responses here. He was unable to point to specified parts of his body, but understood the nature of this task. He could sometimes carry out simple directions but any involving two separate commands were too difficult. In picking out one of four pictures to illustrate a word or phrase read to him, he succeeded with only a few of the easier items of the test (Gates Word, Phrase, and Sentence Reading Test, given orally).

Arithmetic. No. 56 had great difficulty with all arithmetical performances. Analysis showed that series meaning was disturbed; he usually understood the terms "before" or "after" correctly, but could not give the right number. Collectional meaning was likewise disturbed; he usually failed to select from a group of toothpicks a given number, and could not select from several groups one containing a given number of toothpicks. Relational meaning was disturbed, but less so. He could not name coins, nor pick them out. Given a number of coins and asked to make ten cents, he counted out ten pennies; asked to make twenty-five cents he picked out two dimes and five pennies; but asked to tell how much made a quarter, he said "ten pennies." He was unable to solve simple arithmetical problems with coins.

He solved three of the first ten printed *arithmetic computations* (Stanford Achievement Computation Test).

He was unable to do any *arithmetic problems*.

Performances on language intelligence tests. No. 56 understood the problem of the *Opposites Test* and gave five correct responses in 157 seconds, a performance below the normal in both score and speed. The Part-Whole problem he was unable to grasp.

He could not give any definitions on the *Stanford Binet Vocabulary Test*, usually saying, "I know but I don't know." He attempted a few:

tap: "is a house, scold . . . name . . . you give to it . . ."
scorch: "house, it's a house."
orange: "pieces of . . ."
envelope: "I know what you do with it, I know what it is, but I can't tell you."

He was not oriented for time; he could not give the day, month, or year; and was unable to state or guess the time of day. He could not say what time he usually had lunch, but indicated 12.30 on the clock. His wife remarked, "If you tell him, 'Come some place at twelve,' he knows but can't call it." He could not tell his age.

Reproduction of verbal material. He could repeat six digits, four letters, four words, four nonsense syllables, and sentences of as many as fourteen syllables. These performances were remarkable, first, because they were the only language responses falling within the normal ranges and, second, because they were superior to his understanding of spoken language.

Non-language performances. All work was with the left hand.

Performances on the tests of the Shorter Pintner Paterson Performance Scale were for the most part of a typically low-grade trial-and-error type, with occasional but infrequent evidences of insight; and so slow that three of the tests were not completed.

He could not do four tests of the *Pintner Non-Language Scale* at all, failing to get the idea in spite of repeated instructions orally and by pantomime. He got three items correct on the Imitation Test and five on the Drawing Completion, both performances within normal ranges.

He was able to copy a square and a diamond acceptably, and his *drawing* of a chair was not poorer than those of the lowest normals. When asked to draw a man, he first made a crude outline of a house; and when the request was repeated, a recognizable table.

He had considerable difficulty at first in understanding the problem of the *Porteus Mazes*. His final score was better than that of the lowest normals.

No. 60. *A case of predominantly receptive disorder in a left-handed person who had been trained to write with the right hand and whose language disturbances appeared largely in reading and writing. The lesion was an adenocarcinoma of the left temporal lobe.*

Female, white, 51; housewife; tenth grade at school, left at 16 because of illness; left handed for everything but writing and sewing and trained to use the right hand for these.

Psychological Summary

The aphasia was predominantly receptive, but the pre-operative picture was by no means clear. The most pronounced disturbances were in reading and writing. These performances had presumably been acquired about the same time, with the training of the right hand for writing. They were the only ones markedly disturbed with the left-sided lesion. Spontaneous speech was freely and correctly articulated and was abnormal only in that the patient had occasionally to hesitate for names, usually proper names, which she could not remember. Slowness in evoking the correct names was apparent on naming tests. The patient's understanding of spoken language was good. The difficulties in reading formed the most prominent part of the disorder. Letters and words were identified wrongly; there were gross errors in the oral reading of connected material, which made the passage incoherent; and the patient's understanding of what she read was very poor.

The disturbance in writing was also marked, and was not typical of the usual receptive disorder. Grammatical structure and verbal usage remained satisfactory, but the patient often experienced difficulty in forming letters, frequently substituted one for another, and sometimes misformed a word so greatly that it was unrecognizable. Arithmetical performances were low, and the patient sometimes misread numbers as she did letters. Responses on language intelligence tests were qualitatively comparable to those around the medians of the normal group, but the patient was much slower than the normal in producing words on the controlled association tests. Difficulties in drawing were severe enough to place the patient among the poorest of the normal group and, in view of the relatively high intellectual level, to indicate an actual deterioration. The errors in representing the object correctly in drawing were interesting because of the patient's difficulty in constructing letter-forms correctly in writing.

Post-operatively the aphasia was severe and the patient's condition unsatisfactory for detailed study. The findings were extremely important, however, for they showed a more typical receptive disorder than had existed before operation. Even during her best period about a week after operation, before the second deterioration appeared, the patient hesitated for words far more frequently than she had before operation and she also misused words frequently. Only rarely did she name an object correctly, and she was often unable to select objects to oral command. Her understanding of spoken language was seriously limited, though she responded correctly to simple questions during the few days when she was at her best. She recognized only a few letters or words in reading, and wrote only a few letters. After the third post-operative week she made almost no language responses and showed very little reaction of any kind to questions or directions.

Neurological Summary

Since the age of 16 the patient had had severe migrainous headaches occurring about once a week. Three months before admission to the University Hospital she complained of severe occipital headache mostly on the left side, accompanied by tinnitus and frontal headache. Two weeks before admission she began to have severe vomiting spells. During these three months there was increasing evidence of aphasia with particular difficulty in reading and writing. The patient also had difficulty in vision and there were bilateral choked discs of about 2D., more marked on the left, with enlarged blind spots. Visual acuity was: O.D. 6/22; O.S. 6/22. Neurological examination showed that she had a distinctly ataxic gait with a tendency to stagger to the right and left. There was also a slight weakness of the lower right face. X-ray examination was negative. An audiogram showed 30 per cent loss of hearing for speech in the right ear and 32 per cent in the left. Blood Wassermann was negative.

Dr. Frazier exposed the entire left temporal and the adjacent parietal lobes. An encapsulated tumor was encountered about the depth of 5 cm. in the parietal region and was removed. The pathological report showed it to be a metastatic carcinoma.

The patient did well for about a week, but then became progressively worse. She died four months after operation. There was no autopsy.

Psychological Report: Pre-operative Condition

Speaking. When first studied two weeks before operation the patient had been complaining for three months of increasing difficulty in producing words to express her thoughts. Examination showed her *spontaneous speech* to be free and easily and accurately articulated. She clearly had some difficulty, however, in remembering proper names. Her voice tone was unnatural.

She gave *automatic word series* easily and fairly rapidly, saying the days of the week in 5 seconds, the months of the year in 6, and the alphabet in 7.

Naming. The difficulty in remembering names, of which she complained, was apparent from her hesitations in naming tests. In naming the Kuhlmann Line Drawings of common objects, there were several pronounced hesitations when she explained that she recognized the object but could not think what to call it. Within a few seconds to a minute she always produced the word correctly. She was also able to name colors correctly, although here, too, she hesitated several times.

Repeating. The patient was able to repeat words and short sentences with ease and did not experience any difficulty in articulation on longer sentences.

Understanding spoken language. She followed the oral directions of Head's Hand, Ear, and Eye Test without hesitation. No difficulty in understanding spoken language was apparent from her responses to the various test directions or from rather extensive conversations with her.

Reading. The disturbance in reading was severe. In reading single letters aloud, as in naming objects, No. 60 occasionally hesitated. There were always one or two letters in a series which she misnamed, and "p" and "q" were particularly likely to be among these. One of the Gates Visual Selection Tests was given to see if she reached a normal speed in picking out that one of 5 or 10 words which was identical to a given word. Her score, which fell near the normal median, showed no disturbance in the differentiation of letter- and word-forms. At the same time, when the test was continued beyond the usual time limit and the patient had to deal with longer and longer words, she began to make many errors. On the whole, it seemed probable that she had some slight disturbance in recognizing similarities between letter- or word-forms, but that the greatest difficulty arose in recognizing the symbolic value.

In *oral reading* her errors were rarely mispronunciations, but consisted largely in the substitution of a word which usually resembled the printed word in a particular characteristic or in the form of the whole. She read only 30 or 40 of the 100 graded words of the Gates Pronunciation Test correctly, a performance far below the normal for a person of her original ability. In reading connected material, she sometimes tried to correct gross errors which she recognized as incoherent. For example, after reading the sentence,

"He said, 'I will not run away again'"
as:
"He said, 'I . . . I saw there run among another'"
she said: "Don't seem right, I saw them run among others" (Gray Oral Reading Paragraphs, Set I).

Her *understanding of printed material* was seriously disturbed, reaching only the level of the poorest literate normals to whom she was far superior in both ability and education.

Writing. Disturbances in writing were also severe. In *spontaneous writing* the structure was on the whole normal; the few incoherent passages probably resulted from letter and word errors. These were frequent. The patient would sometimes be unable to start the word at all, because she could not "think how the letter went." More often she would substitute one or more wrong letters, occasionally changing the whole word so that it could not be recognized. Typical errors appeared in the following sentence:

> *On* of the *surses* took me down stairs and I *stoop* for *meary* an *orcher* and then sent me back and g did not use me.

She usually recognized only the more serious errors. In the above sentence she did correct the "g" in attempting the word "did," but the only other mistake which bothered her was "orcher." On this she commented as follows: "It makes me so provoked; I want to write 'hour.'" Asked to spell "hour" aloud, she did so correctly.

In *writing to dictation* her errors were similar to those of spontaneous writing.[18] Letter dictations showed occasional confusions or total failures when the patient could not "think how to make" the letter, and there were also errors in writing the alphabetical series though the patient could say it correctly. In writing words to dictation she fell slightly below the lower quartile of the normal group (Morrison McCall Spelling Scale). With the simpler words her difficulty arose largely in the formation of the initial letter. Longer words were usually grossly misformed, but some few of them, for instance "character," were correct. It was evident that her spelling had once been on a higher level, and that occasionally words were still produced freely and accurately, without the break in the performance which resulted when she could not form a letter properly. When sentences were dictated, her errors were more extensive and serious; misformed letters appeared and the score was relatively lower than on the word dictation test (Stanford Dictation Test).

No. 60 *copied* single words from large print into script without error. Given a short paragraph in ordinary type to copy, she started well, although slowly, but in the second sentence began to make errors by omitting letters and substituting one for another. These increased in frequency and after 75 seconds when she had written 10 words, she gave up in great distress.

---

[18] No. 60 had greater difficulty in writing with the left hand than with the right, and not only as a direct result of awkwardness in the use of the unaccustomed hand. She could not form either the words or the component letters so well. It seemed that the greater difficulty from the point of view of motor performance emphasized the more complex disturbances in letter- and word-formation.

When so many of the patient's errors in writing were clearly the result of difficulty in forming the letter, it was natural that her *oral spelling* should surpass the written. Tests showed the difference between the two levels to be great; her performance in writing words did not reach the lower quartile of the normal group while that in oral spelling was slightly above the normal median.

Arithmetic. On printed *arithmetic computations* the patient fell slightly below the lower quartile of the normal group (Stanford Achievement Computation Test). She understood the arithmetical symbols and solved all the one- and most of the two-place examples correctly. Occasional errors in reading series of numbers, when this performance was tried out, indicated one probable reason for her confusion on the longer computations.

Disturbances in reading were too severe for the patient to attempt printed arithmetic problems (Stanford Achievement Reasoning Test). On *oral problems,* although she did not reach the median of the normal group, she stood relatively higher than on printed computations.

Performances on language intelligence tests. When the stimulus words were presented orally, the patient was able to give correct "opposites" to all of the 20 easy words of the list, thus surpassing the median of the normal group. As on the naming tests, however, her hesitations were marked, and she fell among the poorest of the normal group in the rate of her responses. A more difficult *controlled association test,* the Oral Analogies, showed a performance almost equal to the normal median in score, but again very slow.

The patient's score on the *Oral Absurdities Test* was a little above the median of the normal group, an interesting proof both of her relatively satisfactory understanding of spoken language and of her intelligence in a language situation requiring insight and a good "common-sense" reaction.

Her vocabulary, as measured by the *Stanford Binet Vocabulary Test* with the words presented orally, was only just above the lower quartile of the normal group. She was unable to define as many words as would have been expected of a woman of her education and ability, and seemed to have difficulty both in recognizing words which she should have known and in expressing their meaning verbally.

Reproduction of verbal material. No. 60 did not quite reach the normal medians in reproducing series of digits, letters, or unrelated words immediately after oral presentation, nor in the length of the sentences she could repeat.

Non-language performances. As in so many tumor cases where examinations had to be made quickly in the short period of observation before operation, non-language tests were largely neglected. Because of the patient's difficulty in producing letter forms, however, almost all the drawing tests were made.

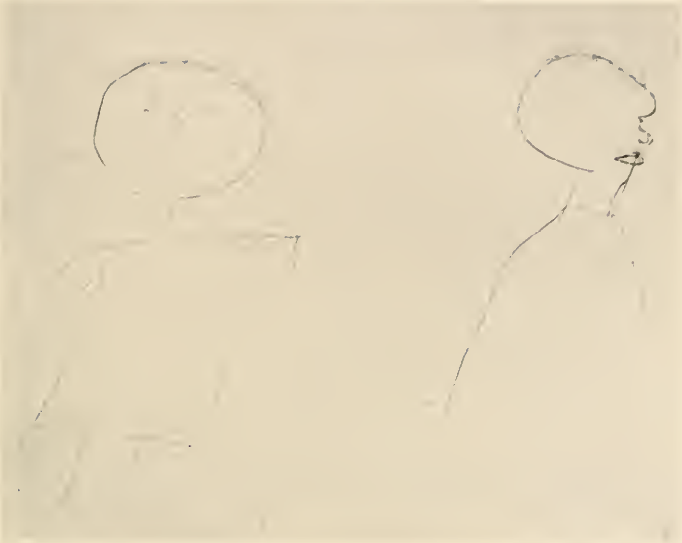


Figure 26. Drawings of a man: Case No. 60

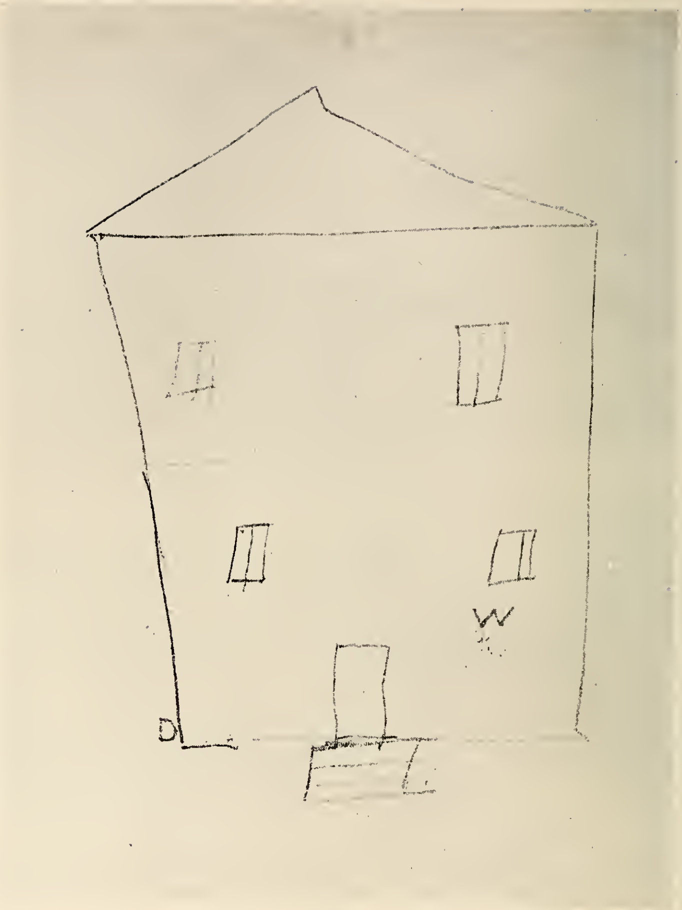


Figure 27. Drawing of a house: Case No. 60

She was able to *reproduce complex patterns* traced by the examiner about as successfully as the median of the normal group (Imitation Test of Pintner Non-Language Scale). She did much less well in drawing from memory lines shown to her on a card for 10 seconds, falling far below the median of the normal group in both the speed and accuracy of her drawing (Kuhlmann Test of Immediate Recall).

Her performance in *completing drawings* was faulty, comparable only to those of the poorest of the normal group (Drawing Completion Test of the Pintner Non-Language Scale). In several drawings she failed to recognize the missing part. Confronted with the picture of a foot with four toes, she saw that one toe was missing, but added it outside of the big toe instead of on the other side of the foot. Even her correct completions were rather clumsily made.

The difficulties shown by the Completion Test appeared to a marked degree in *drawing from a model and from memory*. The patient's drawing of a chair from a model gave no indication of perspective, and represented the chair as seen from the front instead of cornerwise. It had, however, a back, seat, two legs, and one stretcher, and scored a little higher than the lower quartile of the normal drawings. Simpler problems in drawing from a model, such as drawing a glass or a hand laid flat, palm down on the table, were not well done, but, like the drawing of a chair, were probably within the normal range.

Drawing from memory was even more defective and, although No. 60 complained that she had never been able to draw, the extremely poor performances in a person who had undoubtedly been above average in intelligence seemed to show actual deterioration. Two of her attempts to draw a man are reproduced in Figure 26, page 542. A is her first and best drawing, which still fell below the lower quartile of the normal group in score, and B her only attempt at a profile drawing (Goodenough Scale). In B, she drew the top and back of the head first and attempted to put in the features only after a great deal of urging. The lower loop just above the neck-line is the mouth, and was named as it was drawn. Both figures were drawn with the right hand. It will be noticed that the profile figure faces right, the typical direction for the left handed.

Drawing a house was equally difficult for her (Figure 27, opposite). As she first made the drawing, there were two windows in the upper floor, one in the lower floor at "W" and a door indicated by several sketchy loops at "D." The patient then erased these loops and hesitated for some time. Asked what they had been intended for, she said "a door." She did nothing further until she was asked which was the front of the house, when she said, as if a new thought had come to her: "Oh, the door ought to be on the front of the house, oughtn't it?" She then erased the one first-floor window, put in the two as indicated in Figure 27, and the door. The steps caused some hesitation, but once begun were finished quickly.

The evidence from the drawing tests as a whole seemed to indicate unusual difficulty in representing well-known figures. The patient's productions were crude. The drawings from memory were even less satisfactory than those from models, and showed some grotesque representations, such as the features in the profile drawing and the first attempt at the door for the house. It seemed evident that she failed to understand some of the structures in question. In completing the drawing of a foot with four toes, she recognized that a toe was missing, but not the side of the foot it belonged. In drawing a house from memory she may have been uncertain as to which face of the building she was attempting to show. In any case, the question "Which is the front of the house?" suddenly seemed to lead her to a better understanding of the position and structure of the door.

This was the only instance where an improved performance seemed to result from a new verbal expression. In other cases she named some part of her drawing correctly or even described its structure, and yet represented it on paper very badly. Responses of this nature show that her difficulty was not only on the side of understanding the structure; she was also unable to construct a good representation of the object in question.

In tracing the *Porteus Mazes* the patient fell in the lower quartile of the normal group. She seemed to fail largely because she could not follow the paths with her eyes steadily enough or for a long enough time to get a satisfactory visual analysis of the maze, but one important cause of this failure was undoubtedly her physical and mental distress on the day of this examination.

Psychological Report: Post-operative

SPONTANEOUS SPEECH. For the first few days after operation, the patient made no *spontaneous speech* response, only once or twice uttered a word, "no," and did not follow any spoken directions. She then began to ask for one or two things by name, and to use a few words and even simple sentences in answer to questions. As soon as her speech progressed beyond this early stage and she attempted longer comments and true propositional expression, it was evident that her words were sometimes confused, with a tendency for the error to perseverate. Furthermore, speech was fragmentary because of the frequent words which she could not evoke. Syntactical structure seemed not to be affected, at least within the limits of the simple statements the patient attempted.

The following example of her best and most extensive speech, which was recorded just a week after operation, shows the frequent hesitations and the verbal errors.

> (Do you eat more now?) Why, I don't *smell,* not good . . . I just try to draw something . . . (Is your boy coming up?) No, I don't want him to come. (When will you let him come?) I don't want him to *draw* . . . I don't know what will become of him . . . you see, Saturday he's through *work* . . . No, not Saturday. (Is he through school?) Yes, Thursday's the last day . . . (Will there be someone at home to take care of you?) Uh-huh,

> I think Aunt Mary's going to *left* me (What?) I guess Aunt Mary's going to *left* me. (Is she there now?) No . . . I think . . . oh, pshaw . . . going to . . . oh pshaw . . . (Indicated by gesture that she couldn't explain.)

No. 60 had no difficulty in articulation, and words were produced accurately, but she sometimes, especially when tired, mumbled so that her words could not be distinguished. During the second week after operation her speech became more and more scanty, and by the end of the third week it was difficult to elicit even a "no" or a "yes."

About a week after operation No. 60 could count to 20 when started by "one," but she could not give any other *automatic word series* correctly. Started on the days of the week, she slipped over to the months, but did not finish the series of months.

Naming. Before operation the patient had occasionally hesitated for names of objects shown her, but had almost always given them correctly in the end. Even during her best week post-operatively, though she sometimes asked for objects correctly when she wanted them, she was almost never able to name a single object in a test series. Her responses were sometimes garbled words and sometimes good words but incorrect names, like "tumbler" for "knife." The errors frequently perseverated; when the patient suggested "tumbler" as a name for "knife," she rejected it spontaneously, but gave it again shortly afterward as the response for "penny" and "matches." She would sometimes attempt to describe the use of the object, but generally without success. A pencil, for instance, was "to put in the water." She often could not select the correct one of several names presented orally and she was only about 50 per cent right in selecting objects from a group to oral command.

Repeating. No. 60 repeated many single words or short and familiar phrases correctly, but she would often substitute one of the phrases which had earlier been correct instead of repeating the new one. Perseverations were particularly marked toward the end of a test. She never reproduced a sentence of as many as six syllables correctly.

Understanding spoken language. Immediately after operation and again within about three weeks, No. 60 made almost no response to spoken language, but at her best about a week after operation, she understood many but not all questions and followed most single, easy directions. She often could not, as already stated, pick out objects at oral command. More complicated questions and directions tests were rejected as insignificant because the patient fatigued easily and shifted her attention rapidly.

Reading. Even at her best during the post-operative period, she showed very few signs of ability in reading. She recognized only one or two simple words, identified only one or two objects from the printed name, and confused most of the letters in attempting to spell out simple words.

Writing. After operation No. 60 could hold a pencil in her right hand but had not enough power to press it on paper. In writing with her left hand, she made a number of recognizable letters but no good words. She could copy her name from print into print, correcting spontaneously the initial errors she made.

3. EXPRESSIVE-RECEPTIVE DISORDERS

No. 3. *A case of expressive-receptive disorder with severe disturbances in language and non-language processes. The lesion was probably a hemorrhage in the distribution of the left middle cerebral artery.*

Male, white, 54; machinist; education unknown; apparently right handed.

Psychological Summary

The aphasia was severe and affected all language processes. The patient uttered a few phrases in reactive speech but he could not produce these apart from the situations in which they arose naturally. He uttered a number of word sounds in attempting to name objects and a few of these resembled the true names. He could repeat some single words fairly clearly. No signs of reading or letter recognition were apparent, but the patient could write a few letters of his last name and copy some single letters.

On non-language tests he did relatively better than on language tests but his scores fell among the poorest of the normal. It was evident that he could discriminate forms, however slowly, imitate certain fairly complicated movements and copy or reproduce some simple geometrical figures.

No changes were observed during more than a year and a half of observation or on a final study made by a different examiner.

The patient cooperated well on non-language tests but sometimes refused to attempt language tests. His behavior seemed natural in view of his almost complete inability to speak, read, or write. With sufficient encouragement and persuasion he could usually be made to work. His attitude was friendly. He was easy to take care of in the ward. He apparently appreciated funny situations and got a good deal of enjoyment, for example, from watching other patients attempt some of the non-language tests.

Neurological Summary

When 51 years old the patient was found moaning in bed and was unconscious for a short time. The next morning his right upper and lower extremities were weak, his speech stumbling, and he was unable to carry out commands.

On his admission to the Philadelphia General Hospital the following day, the paralysis had increased and affected the right face, tongue, arm, and leg, and the reflexes were increased with a Babinski. Sensation could not be determined. There was a partial ptosis of the right eyelid, the right pupil was irregular but reactive to light, the left being inactive. Ocular tests were unsatisfactory but there was undoubtedly involvement of the internal rectus on the right.

The patient remained in the hospital and in the course of time the ptosis and internal rectus palsy disappeared, leaving him with a hemiparesis and the usual secondary contracture, and a marked aphasia, which was studied 22 months after the onset.

In addition the ophthalmoscopic examination showed an arteriosclerotic optic atrophy on both sides. Both blood and spinal fluid Wassermann were negative.

The lesion was probably a hemorrhage in the distribution of the left middle cerebral artery, affecting principally the motor area.

Psychological Report

Speaking. No. 3 had almost no speech except when angry or surprised. Then he would often swear or utter some phrase such as "Can't ter (tell) you!," "What's that?" or "No, I can't do that." The latter was his longest statement, and he could not produce it either as a whole or in part unless it came almost automatically with his protest against the test situation. The few words he used in this *reactive speech* were not perfectly articulated but still not badly misformed. If the examiner insisted that he attempt to speak further, he would sometimes produce a whole series of meaningless syllables, uttered as the reactive expressions were with fairly normal stress and variety in tone, but the patient himself realized that he was not really speaking. He tried to express himself somewhat by gesture, pointing to his tongue or throat, shrugging his shoulders, or putting up his hand in protest, but he made no attempts at truly descriptive gestures such as indicating quantity or dates by holding up the required number of fingers.

The patient had no success with *automatic word series*. He could repeat a few numbers or letters of the alphabet as the examiner said the respective sequences, but he could not add any items in either series himself. He could not arrange block letters in alphabetical order or add the next letter to any of the sequences begun by the examiner.

Naming. In attempting to name objects, colors, or pictures he made various speech sounds but from the many trials the only sounds which resembled the true words in any way were "pree" and "shee" for "key," "sewer" for "scissors," and "eller" for "yellow." When he could be persuaded that the effort was worth while, he was able to point out all but one or two of the objects of Head's Test to oral command. He had very little success, however, in pointing out colors to oral command and none in pointing out objects or colors to printed command. He could match the objects or colors correctly.

Repeating. No. 3 repeated some single words so that they were much more clear than his attempts to produce words in naming. There were many he could not repeat, however, and even those which were recognizable were usually poorly articulated.

Understanding spoken language. No. 3 could not follow any simple commands or indicate an answer to questions. The fact that he could select objects correctly on Head's Test showed that he did recognize some spoken words, however. The only further evidence that he understood spoken language unaccompanied by gesture came from occasional responses in a natural situation. Once when he started to wheel his chair away, the examiner said in her usual tone of voice, "You're not through"; the patient unexpectedly said, "Oh, all right," an expression which he used only this one time, and wheeled his chair back. Another time when he refused to try some test, the examiner said, "You're the laziest man who comes here!" The patient immediately and with some indignation said, "Oh, I'm not!"

READING. There were no evidences of ability in reading or in recognizing block letters. The patient could not name any of the letters nor could he point to any correctly at oral command.

WRITING. No. 3 could not write any word completely, not even his name. In trying to write he had to use his left hand, and the few letters he wrote of his name were either written in mirror script or written from left to right but upside down. He could copy many single letters in print but when copying any word, even his name, he made errors.

ARITHMETIC. Although No. 3 could not count in automatic word series, he could count objects up to four; he could not go beyond four nor tell the sum of the objects up to four. No further signs of arithmetical skills were demonstrable.

NON-LANGUAGE PERFORMANCES. Non-language tests showed great deterioration but still relatively better responses than language tests. The patient had to carry through all the work with his left hand. He completed all the *formboards* of the Shorter Pintner Paterson Performance Scale, and in every case his scores for both speed and quality were within normal ranges. Except for the Healy Puzzle A, however, they all fell among the poorest of the normal scores.[19] He completed the Mare and Foal Puzzle and the Manikin, but not the Feature Profile. Neither the Ship Test nor the Picture Completion showed any sign that he recognized the pictorial content. He was unable to imitate the movements on the Adaptation Board, but he did imitate six of the patterns on the Knox Cube Test—a relatively satisfactory performance.

He could copy a circle, a square, and a triangle but not a diamond. He was able to reproduce some simple geometrical figures from memory, but he could not draw objects from memory nor from a model.

No. 19. *A case of expressive-receptive disorder with high non-language performances. The lesion was probably traumatic causing minute vascular changes, mostly in the left side of the brain.*

Male, white, 41; skilled mechanic; high-school education, at least; right handed.

---

[19] He could always arrange the two triangles to form a rectangle on the Patience Test of the Stanford Binet, Year V. He made no errors on the test of discriminating geometrical forms of the Stanford Binet, Year IV.

Psychological Summary

The expressive-receptive disorder led to severe limitation in all language processes. Very few words could be produced in speaking and many of these were articulated or formed badly. Understanding of spoken language was limited to single familiar words and some simple questions. Understanding of printed material was slightly better, and the pronunciation of words in reading superior to the production of words in speaking. Although the patient could copy words fairly well, his writing was limited almost entirely to his name, his wife's name, and their address. Performances on printed arithmetic computations were far superior to any others involving verbal terms; outside of the non-language, they were the only performances reaching the lower quartile of the normal group (Figure 24, page 420).

Non-language performances, considered as a group, were superior to the normal. On the whole those which did not depend so directly on speed compared most favorably with the normal. Since there were no means of estimating the patient's former ability in work of this type, it was of course possible that even the good performances might represent some deterioration over those which would have been characteristic before the disorder. When his responses were strikingly good, however, as on the Stenquist Mechanical Aptitudes Test where he was surpassed by only 17 per cent of army men, it seemed most likely that they were approximately as they would have been before the disorder.

The patient cooperated extremely well except on one or two days when he complained of severe headache. He was good humored and fond of a joke, but deeply discouraged by his prolonged incapacity and the lack of improvement. He seemed to have considerable insight into his disorder. He had managed to retain some of his former interests, baseball for instance, and his social attitudes and relationships within the hospital seemed normal.

Neurological Summary

At the age of 32 the patient had a motorcycle accident which resulted in a fracture of the skull and a concussion of the brain. From that time on his behavior altered from that of an educated, church-going person to that of a rather coarse individual. He was profane, and his attitude towards his family was utterly different. He continued to work in an automobile repair shop, however, for about two years, when he developed a right hemiplegia and aphasia. The attack was preceded for a week by restlessness, irritability, dullness, and twitching of the face. After the onset the hemiplegia gradually lessened but the aphasia did not improve.

He was admitted to the Orthopedic Hospital by Dr. Leavitt seven years after the onset of the aphasic symptoms and it was at this time that the psychological studies were made. Examination on admission showed a moderate right hemiplegia in which the leg was mostly involved. The right leg was spastic but the patellar jerk was diminished and there was no Babinski. Sensation was presumably normal. The pupils were unequal, the left being larger than the right. Ophthalmoscopic examination showed normal fields with some peri-papillary atrophy on the right suggesting an old papillitis, the disc being slightly hazy on the left, the color being not so good as on the right. The blood Wassermann was negative.

Undoubtedly the fracture of the skull with the accompanying concussion produced minute changes throughout his brain which were responsible for the alteration in his personality and the subsequent symptoms. As a rule a hemiplegia does not occur in a person under 40, unless it results from direct trauma, brain tumor, cerebral syphilis, or embolism. It is therefore a justifiable assumption that the development of the hemiplegia and aphasia was the indirect result of the preceding brain trauma.

Psychological Report

SPEAKING. *Spontaneous speech* was usually limited to a few words and speech-sound-combinations, notably: "no," "yes," "oh," "old," "dumb," "little," "nogood," "right," "sure," numbers and an explosive negation "nothaire." These words were produced fairly easily, and some of them, supplemented by gestures, were likely to be repeated several times in one attempt at expression. Other words were occasionally produced, with greater effort and more defective articulation, but the vocabulary in ordinary speaking never reached 50 words.[20] An example illustrating his longest and best expression during the two weeks of study will show how incomplete his speech was, with one or two key words supplemented perhaps by several others of the words frequently used.

> He had been writing numbers to dictation and after writing "1,000,000" correctly, he spontaneously wrote "93,000,000," pointed to the sun and said: "Old, old . . . not here . . . earth here one . . . sun . . . old here, lessein . . . here . . . earth hot."

Reactive speech was occasionally more extensive than ordinary spoken expression. Given a paper and asked to write, for instance, the patient said clearly "What do you want here?" The question was both longer and more clearly articulated than any unit of his ordinary expression.

Automatic word series were also superior to other speech utterances. The patient could count to 50 or 100 with very few omissions, and fairly correct articulation. After several false starts, he could say the names of the days of the week in 11 seconds, but he could never say more than one or two of the months. He could not go beyond "i" or "j" in the alphabet.[21]

---

[20] This total did not include numbers, which he seemed to produce fairly readily, nor the days of the week which he could say in series. On each of the 12 examination days, conversations were attempted, on the examiner's part by means of oral questions, printed key words, sketches, gestures, newspaper clippings, etc. The patient was interested and always made a great effort to respond; he gestured well, drew maps and pictures, pointed to printed words, and tried to produce some oral expression. The limits of his vocabulary for ordinary speaking seemed fairly definite: on the first day he used 33 words, aside from numbers; on five of the succeeding 12 days he added from one to five new words.

Naming. No. 19 could name only two or three common objects or colors of Head's Tests correctly. Many of the names he was unable to produce at all; others were badly garbled. By gesture he was able to indicate the use or nature of the objects, and at oral or printed command he could almost always select the correct object or color from the group presented.

Repeating. He could repeat many single words accurately, but only a small part, if any, of longer sequences, even if these were such familiar sentences as "What is it?" He was usually unable to repeat the phrases which he produced spontaneously as comments on the immediate situation.

Understanding spoken language. No. 19 could follow a few very simple commands, such as "Point to your nose" or "Open your mouth"; and he sometimes responded correctly to questions about his own situation. Furthermore, he could pick out familiar objects or colors from the respective groups when the names were given orally. These performances, however, represented the extent of his understanding of spoken language, and aside from these his only appropriate responses occurred when he happened to catch the key word in some command, and, either by chance or by sizing up the non-verbal situation, acted on this correctly.[22]

Reading. In *oral reading,* No. 19 produced many more words and word-sounds than in speaking. Nevertheless his pronunciation of single common words was extremely poor, and his version of very simple sentence material largely unintelligible.

His *understanding of printed material* was also very low. When he had to select the correct one of four familiar words to represent a given picture, or the correct one of four pictures to illustrate a phrase or a sentence, he was right in about 75 per cent of the trials (Gates Word Recognition Test, and Word, Phrase, and Sentence Reading Test).

All reading processes were far below the levels of the poorest literate normals. At the same time it was obvious that they showed relatively less deterioration than the patient's other language processes: he could pronounce correctly or come close to the pronunciation of many more words in reading than in speaking or naming or any other form of language production and he could understand relatively better from the printed than from the spoken word.

---

[21] When an alphabet of block letters was dumped out for him to arrange in order, he straightened the letters so that each was right side up and laid out A, B, C correctly and further across the table M and N, showing that he knew the position of these letters and about how much space would be needed between the groups. Placing the other letters, however, gave him a great deal more difficulty and his final alphabet at the end of five minutes was: A B C E D F I G J L K M N S R O T H P U W Q V X Z.

[22] Tests of understanding and of repeating showed that he did not always grasp the word-sound correctly. He would, for instance, repeat a sound similar to the given sound, when the error was not a difficulty in articulation and when he himself was unaware of it. Tests of non-speech sound recognition showed no difficulty: he could always select the correct objects and reproduce the sounds made for him, ringing a bell, for instance, or choosing the object of suitable weight and material to make a given sound when dropped on wood.

Writing. *Spontaneous writing* was limited almost entirely to the patient's own name, his wife's name and their address. Even these contained errors: the wife's name, "Hannah," for instance, was written "Hannnah," and the city "Reading" was written "Reagind." He sometimes attempted to reach a word he needed by tracing in the air or by starting to write it. In neither case, however, was he ever successful in producing more than the first one, two, or three letters, and it was clear that his production of words in writing was even more limited than in speaking. He was several times unable to write more than the first one or two letters of a word which he was saying aloud correctly.

To dictation, No. 19 could write many but not all of a random series of single letters. His difficulty lay rather in identifying the letter which the examiner pronounced than in forming it properly. He only once or twice wrote a word to dictation correctly: the combined difficulties of grasping the word dictated and spelling it were too much for him.

When *block letters* were given him, he could pick out and arrange those which spelled his first and last, but not his middle name. He could not construct any other word, whether spontaneously, as a name for an object shown, or to dictation.

In *copying,* he could reproduce single words fairly accurately, and even sentences did not contain many errors. When he copied connected material, he wrote words such as "time" or "year" after looking at them once, but for longer words he had to look back to the text at least once in the middle of the word.

Arithmetic. No. 19 was never certain of the printed directions "add," "subtract," etc., but he understood the arithmetical signs for the various processes. His performances on printed *arithmetic computation* tests were very much superior to any of his language performances. On the test where normal scores are available for comparison, his score fell near the lower quartile of the normal group (Stanford Achievement Computation Test).

In view of his difficulty in understanding printed material, the printed *arithmetic problems* naturally went less well; the patient's score fell among the poorest of the normal group (Stanford Achievement Reasoning Test).

Performances on language intelligence tests. The patient's language responses and his understanding were all too limited for him to attempt the language intelligence tests. A special experiment was arranged to see what his sentence structure was like when he did not have to produce the words himself. The words "and," "best," "big," "boy," "can," "city," "do," "is," "make," "men," "the," "where" and "work," printed singly on cards, were laid before him in alphabetical order, and by means of oral directions and gesture, he was made to understand that he had to arrange the cards so that they would say something. The results were as follows:

Patient's response	*Time*	*Examiner's response*
the work	60″	
	120″	"the" and "work" put back in order and he was asked to try again
	180″	"where is the boy" arranged for him
where men	218″	
where men city work big	235″	
men big work city	248″	
is men big work city	259″	
the men work can best	271″	
the men is can work	300″	

The patient had no further solution to offer, but was still obviously dissatisfied. It was very clear that he could not construct sentences of simple words even when he recognized these fairly well individually. The experiment showed, just as the experiments with block letters in the formation of words had shown, that the disturbances in expression went beyond simple executive mechanisms and revealed serious limitations in the processes of word and sentence construction.

Reproduction of verbal material. No. 19 could repeat numbers and most letters singly, but he could not repeat two together, unless perhaps he had heard and repeated each separately. Shown series of printed numbers and letters on cards he could reproduce four digits or three letters correctly in writing, but not orally.

Non-language performances. Of the patient's scores on tests involving language directly only one, that for arithmetic computations, reached the lower quartile of the normal group. With the scores on non-language tests the situation was very different, 86 per cent of them reached the lower quartiles of the normal group, 64 per cent reached the medians, and 28 per cent the upper quartiles (Figure 12, page 280). Further analysis of the group of non-language performances showed that 92 per cent of his scores on tests relatively independent of speed exceeded the normal medians, but only 12 per cent of his scores on direct speed tests, such as the Seguin Formboard or the Substitution Test. It was evident that the non-language performances as a whole would have been even higher in relation to those of the normal group if the patient had been able to work more rapidly.

He filled in the *formboards* competently and with little evidence of trial-and-error behavior (Shorter Pintner Paterson Performance Scale). He was superior to the medians of the normal group in imitating complex movements (Knox Cube Test and Imitation Test).

He was well above the normal medians on the *Drawing Completion Test,* the *Reversed Drawing Test,* and the *Picture Reconstruction* (Pintner Non-Language Scale). He enjoyed drawing and made frequent use of sketches when he could not express his meaning verbally. One of these was a rough sketch of a dinosaur. The patient could not name the animal nor produce any words to describe it, but his drawing was well proportioned and easily recognizable, and included such characteristics as the ridges along the back. Another was a spirited drawing of a giraffe, which he called a "gaff . . . gaffin." Several times he drew rough sketches of machinery to try to explain what sort of work he had done. Once he drew a side view of a machine bolt together with a nut for it. The side view showed the standard method of indicating the hexagonal head of the bolt, and there were other signs that he remembered the technical methods of representation. The drawing had one flaw, however, the diameter of the screw thread was greater than that of the body of the bolt, but the patient was really not attempting to turn out a finished product.

The *Stenquist Mechanical Aptitudes Test* was given to compare the patient's performance in assembling various mechanical devices such as bells and locks with the performances of army men. He did very well, obtaining a score surpassed by only 17 per cent of the army men tested. It was evident that he wasted no motion and required little overt fumbling. For some of the complicated articles he looked over the parts one by one, laid them out approximately as their positions would be and, after considering this arrangement as a whole, proceeded with the actual assembling.

No. 26. *A case of expressive-receptive disorder with language processes extremely limited and many non-language performances relatively satisfactory. The lesion was probably a thrombosis of the left middle cerebral artery.*

Male, white, 44; laborer; education unknown; right handed.

Psychological Summary[23]

The aphasia was severe and affected all language processes. The patient uttered very few words and most of these were more or less automatic responses such as "Nossir!" His most frequent expression was a stereotyped phrase "kinakootch" which he used in many different situations and with great variety of inflection and accent. His gestures were accurate and fairly extensive; he would try to answer questions involving numbers by holding up the required number of fingers. He could carry a tune well. In naming objects, pictures, or colors he produced only meaningless sound combinations, but he could select the objects of Head's Test correctly to oral command, and also from the printed name. He came nearest to uttering true words in attempts to repeat single words or short and familiar phrases. He understood many simple questions and could

[23] The necessary facts in this case can be included in the Psychological Summary and the more detailed Psychological Report has therefore been omitted.

carry out single but not twofold directions. His comprehension of printed material was apparently about equally limited. The extent of his spontaneous writing was his name and a few incomprehensible syllables such as "stat." In one instance, however, he wrote a true word: he was very anxious to express the fact that his wife was waiting for him and could say nothing but "kinakootch"; he suddenly picked up a pencil and wrote the word "wife." He could copy single words in print fairly well.

He did better in arithmetic than in any other performance involving language, making a score in printed arithmetic computations which fell just within the lower limit for the normal group. He worked quickly and efficiently on the tests of the Shorter Pintner Paterson Performance Scale and many of his scores fell at or above the lower quartiles for the normal group. Those for the Two-Figure Board, the Casuist Board, and the Healy Puzzle A were better than the medians for the normal group. He reached the normal median in imitating the complex movements on the Knox Cube Test. He could copy and reproduce simple geometrical figures but he fell among the poorest of the normal group in drawing a chair from a model or in drawing a picture of a man.

No major change was observed in the patient's condition during the eleven months of study. At the end of that time, however, he was saying a few more words, notably "yeah," "no," and "I donno."

The patient was extremely cooperative on the non-language tests and less so on the language. At first he did not want to attempt to speak or name objects. He always seemed to be interested, however, in trying to select objects from oral or printed command. He was aware that his phrase "kinakootch" was not a true speech response and he often indicated his discouragement by gesture. On the whole he was cheerful, however, and friendly. He was easily taken care of in the ward and seemed to get on well with the other patients.

Neurological Summary

Six months before admission to the Philadelphia General Hospital the patient had what was diagnosed as a cerebral hemorrhage, causing a right hemiplegia with disturbance of speech. On admission he had a complete right hemiplegia with marked contractures, increased reflexes, and Babinski. There were no sensory disturbances. X-ray and ophthalmoscopic studies were negative. Serological examination was negative.

Psychological studies were begun on his admission and continued eleven months.

He died of a pneumonia about two years after the onset. There was no change in the neurological condition throughout. There was little, if any, improvement in the aphasic symptoms.

The cause of the hemiplegia was probably a thrombosis of the left middle cerebral artery, the lesion being largely motor.

4. AMNESIC DISORDERS

No. 17. *A case of amnesic aphasia. The lesion was a spongioblastoma of the left temporal lobe.*

Female, white, 36; school-teacher; high-school education with several summer school courses toward a B.A. degree; right handed.

Psychological Summary

Pre-operatively the patient showed a severe amnesic aphasia. She had very great difficulty in evoking words and was handicapped both in spontaneous speech and in naming. She understood spoken language fairly well, but, because of the amnesic difficulties, was able to repeat only very short phrases or sentences.

Post-operatively the aphasia was more severe and the type less clear-cut. Spontaneous speech was much more limited. The patient used garbled and unrecognizable words in naming to a far greater extent than she had before. She did not understand spoken language so well as she had pre-operatively, but her understanding was still superior to her expression.

The patient fatigued so rapidly both before and after operation that the examination had to be abbreviated and simple. Because of her motor and visual difficulties she was not asked to read, write, or try any of the non-language tests. She cooperated as well as she could, was friendly and well oriented.

Neurological Summary

Two months prior to admission to the University Hospital the patient suddenly experienced a convulsion lasting 20 minutes with unconsciousness. There was no recurrence of this spell, but during the five weeks before admission she had had considerable loss of vision and increasing difficulty in finding words and naming objects. She also had severe left fronto-temporal headaches, nausea, vomiting, dizziness, and tinnitus in the left ear. On admission there was a very definite right homonymous hemianopsia and uncertain gait with a tendency to fall to the left, but no other neurological symptoms. There was a bilateral papilledema of about 2½D. in each eye. At operation by Dr. Frazier a fronto-temporal bone flap was reflected and a tumor exposed posterior to the Rolandic fissure lying in the temporal lobe. Sections showed it to be a spongioblastoma. Following the operation she developed a right hemiparesis with the usual increase of reflexes but without a Babinski and the speech disturbances were much more severe. There were no sensory symptoms. In the course of time the hemiparesis grew less, but the hemianopsia persisted. Her speech continued to be greatly disturbed. The psychological studies were made before and after the operation.

Four months after the operation her speech became worse and she was reported not to have talked at all from this time until her death two months later. No necropsy was obtained.

Psychological Report: Pre-operative

SPEAKING. *Spontaneous speech* was disturbed by hesitation for words and inability to find words. It was very scant but, so far as could be observed, contained no grammatical or structural errors.

When tested on *automatic word series,* the patient said the days of the week correctly in three seconds and counted easily, but gave the names of the months or the letters of the alphabet only when prompted by the first item of each series.

NAMING. Her most pronounced difficulties appeared in naming. Although she sometimes indicated their use verbally or by gesture, she failed to name most common objects. She once or twice produced a garbled word which was somewhat similar to the correct name. She was able to select the correct name from among several suggested to her orally.

The patient was more successful in naming colors than in naming objects, although she confused some color names and also gave some correct names in garbled form.

REPEATING. She repeated short phrases and sentences with good articulation, but failed to reproduce anything longer than a six-syllable sentence.

UNDERSTANDING SPOKEN LANGUAGE. No. 17 understood simple questions and directions. She was not tested on complex questions because of her pain and readiness to fatigue.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. The patient's difficulties in finding words were so severe that she could not respond well to the simplest of the language intelligence tests. She could not give the "opposite" of easy stimulus words, such as "good," "black," etc.; could not name a number of objects within a given class; and could not express herself directly or completely enough to define common words.

Psychological Report: Post-operative

SPEAKING. For the first three or four days the patient was reported to use only the words "no" and "yes," and to say "no" very decidedly sometimes when she obviously meant "yes." Again according to the nurse's report, she often tried to ask for water but produced only a word-sound like "nan." She next began to use the word "what?" correctly, and then short phrases, such as "All right," "That's good," "What is it?" Eleven days after operation her *spontaneous speech* was still made up of such phrases. Attempts to express ideas or wishes outside of these almost automatic phrases were fruitless. (She would often hum tunes and these were always clearly recognizable.)

The patient could give no *automatic word series.* She would attempt to count when prompted by the first two or three digits, but she produced no recognizable word.

NAMING. Eight or nine days after the operation, No. 17 would attempt to name objects but she was rarely successful. Her responses consisted of garbled words apparently unrelated to the correct name. Some one garbled word-form often persisted with little change in response to several objects. The patient was much less able to choose the correct name from among a series presented orally than she had been before operation.

REPEATING. Until the eleventh day the patient did not repeat any words, even those which she could say spontaneously in an appropriate situation. In attempting to repeat, although she did not get the word-sound, she often imitated the inflection of the test word or phrase. On the eleventh day as she attempted to start counting, she repeated "one," "two," "three," and "four"; although not perfectly formed, the words were easily recognizable.

UNDERSTANDING SPOKEN LANGUAGE. The patient understood simple questions, but she had more difficulty after the operation than before with those slightly more complex or less directly related to her immediate situation.

No. 18. *A case of amnesic aphasia with variations in the severity of the language disturbances according to the condition of the left fronto-temporo-parietal cyst.*

Female, white, 32; housewife; grammar-school education; right handed.

Psychological Summary[24]

The aphasia was amnesic with some signs of difficulty in articulation and word-formation typical of an expressive disorder. The patient's disturbances varied in severity, decreasing after the cyst had just been tapped. Spontaneous speech was sometimes confined to a few words and phrases. Just after the cyst had been tapped it was always more extensive, but still extremely fragmentary and broken by the many words which the patient could not produce. More or less "automatic" speech came more easily than true propositional expression. Although the patient could almost always select the correct objects to oral or printed command, she had difficulty in naming objects and greater difficulty in naming colors. These disturbances were particularly evident just before the cyst was tapped and cleared up somewhat immediately afterward. In such performances as naming colors, where the production of names was a great effort, or on a bad day even in object-naming, she occasionally uttered poorly articulated or misformed words. She had almost no success with language intelligence tests requiring the production of words under specific controlling conditions. Although she fell below the poorest normal in the length of the digit, letter, or word sequence or the sentence which she could reproduce, she repeated short sections readily and with no difficulty in articulation. She understood ordinary conversation and simple directions; she often required several repetitions before she could follow fairly complex directions, such as those of Head's Hand, Ear, and Eye Test. She understood single words in reading, even those of moderate difficulty, and she also understood short phrases and sentences, but she made a great many errors in pronouncing single letters or single and very easy words. Once or twice she wrote a name which she could not speak, but on the whole she was no better able to express herself in writing than in speaking, and indeed was less inclined to do so because of the difficulty in using her left hand. She made occasional errors in copying from print into script with the left hand. She understood arithmetical symbols and was able to solve simple printed computations, but began to fail regularly when the computations were longer and involved three-place numbers. She was much less successful with printed arithmetic problems. Non-language performances were difficult because of the loss of motor function in the right arm and the patient's general weakness; they were apparently somewhat more disturbed than these handicaps would explain.

---

[24] The essential facts have been included in the Psychological Summary so that no detailed Psychological Report is necessary.

Because of her headache and her anxiety about her condition, the patient sometimes did not cooperate well. Evaluation of her performances had to be based on those occasions when she made a good effort, and were less detailed and complete than they might otherwise have been. The patient was emotional and often despondent. She was easily and unduly irritated by various actions of members of her family or of persons in the hospital. Her attitude toward the examiner was friendly, and she enjoyed purely social calls.

Neurological Summary

At the age of 25 following the birth of her first child the patient had a generalized convulsion beginning in the right hand and face, with unconsciousness. A second attack followed three weeks later and six other major seizures preceded and followed the birth of her second child three years later. About the time of the first seizures she also began to have chattering spells of the jaw, trembling of the right hand, and biting of the tongue. These lasted two or three minutes. They were not accompanied by unconsciousness. Two months before admission to the University Hospital the patient had another major seizure and one month before she developed diplopia. Seven years after the first convulsion, when she entered the hospital, the neurological findings were practically negative. There was, however, increased intracranial pressure, with manometer readings between 230–300; the chemical reactions were entirely negative. The x-ray of the skull was negative, but she had a marked bilateral choking, the swelling being 3 diopters in both eyes; the visual fields were normal with exception of large blind spots. An exploratory operation over the left temporo-parietal area did not reveal a lesion, but the patient developed a severe aphasia and had several generalized convulsions.

During the next fourteen months there were only two or three major seizures, but the chattering spells were frequent. The aphasia was reported to have practically disappeared in about three months.

About twelve months after the operation the patient bumped her head when getting into a car and afterwards had her first attack of paralysis of the right arm and leg with numbness and tingling and a senseless sort of speech. This group of symptoms lasted only a very short time, but in the next two months she had three similar attacks. During this time she developed a right lower facial weakness and her aphasia returned. She also complained of dizziness, vomiting, increasingly severe headache, and loss of weight.

On her readmission to the University Hospital neurological examination revealed marked weakness of the right face, arm, and leg with increased reflexes and a Babinski, and paresthesia in the upper and lower extremities. The ocular and spinal fluid examinations were the same as before the previous operation. X-ray was negative except for the large osteoplastic flap. Dr. Grant reflected the left temporo-parietal bone flap and evacuated a large temporo-parietal gliomatous cyst. Part of the tumor was removed. Following the operation the paresis and the speech disturbances gradually diminished, but the convulsions and chattering spells persisted.

About six months after the second operation the patient was readmitted to the hospital complaining of more frequent convulsions, almost continuous headache, apathy, and loss of memory. The psychological studies were begun at this time. Neurological examination showed a right hemiparesis, the weakness being most marked in the right hand, with increased reflexes. There was secondary optic atrophy with slightly contracted fields and enlarged blind spots. On this admission Dr. Grant punctured the left temporo-parietal gliomatous cyst, following which her aphasia became less severe and there was a slight improvement in motor power.

A few weeks later she was admitted to the Graduate Hospital where Dr. Grant again tapped the cyst. About 3 months later she was readmitted to the University Hospital where the same surgeon removed a large gliomatous cyst and a large tumor mass from the left frontal region (astrocytoma fibrillae).

The neurological condition remained about the same after this operation; that is, the patient had a complete right hemiparesis, her headaches persisted and the aphasia was still severe. A year later the cyst was again tapped several times. Three months after this when last reports were obtained she was becoming progressively weaker.

No. 42. *A case of amnesic aphasia with a large abscess of the left central and parietal areas.*

Male, white, 13; in grade 8 at school; right handed.

Psychological Summary

Psychological study, which was made two months after the beginning of the speech difficulty, revealed an amnesic aphasia. The patient spoke in a hesitant and fragmentary fashion; he was frequently unable to produce the words he needed. He almost invariably selected the correct word from among several presented to him, and he usually rejected a wrong word when he himself suggested one. He had made verbal confusions previously, however, and he stuttered a little; apparently the amnesic aphasia was somewhat complicated by disturbances more typical of receptive and expressive disorders. No. 42 understood spoken language relatively well but was extremely limited in reading. He could not pronounce words and he recognized very few of them. His inability to recognize simple words also suggested that the amnesic disorders were complicated by the receptive. The patient could write only a few letters or numbers; part of his difficulty undoubtedly depended on his weakness. He could do only the simplest arithmetical computations and he solved these by counting. Because of his weakness only one complete non-language test was given, the Porteus Mazes: here he was almost up to the normal for his age.

The boy cooperated well. Since he fatigued rapidly he worked for periods of only ten or fifteen minutes at a time. He became discouraged easily, but was on the whole cheerful. He liked to try to talk about his experiences in school or camp; his interests seemed to be normal for a boy of his age.

Neurological Summary

This patient was studied in the Johns Hopkins Hospital through the kindness of Dr. Dandy. The symptoms began with a severe headache, which came on suddenly, lasted a short time, and then disappeared. This was followed by alternating periods of headache, vomiting, drowsiness, and freedom from these symptoms. Because of a sudden attack of Cheyne-Stokes respiration it was thought that the boy had a cerebro-spinal meningitis, but three spinal punctures showed in each instance an increased cell count but no definite bacteriological findings. On admission there were some evidences of meningitis, as shown by stiff neck and positive Kernig's sign. The patient was dull and apathetic and complained largely of headache. There was complete paralysis of the lower right face and arm, but the right leg was not very weak. The reflexes were increased but with no Babinski. The spinal fluid studies on admission showed no organism, the cell count was 800, 65 per cent being mononuclear. The tuberculin test was negative. Ophthalmoscopic examination showed slight ptosis of the left lid, paralysis of the right 6th nerve, definite choking of the disc on both sides, the swelling being 2½ to 3D. on the right and 1½ to 2D. on the left, with hemorrhages mostly on the left. Because of these findings the diagnosis of meningitis was abandoned and it was thought that the patient had either a tumor or an abscess on the left side of the brain.

He was first operated upon by Dr. Dandy one month after the onset, and following this a number of operations were performed which showed a large abscess in the left central and parietal areas. Following the operation the patient developed a greater weakness on the right side and a right homonymous hemianopsia and generalized convulsions.

About two months after the first operation or three months after the onset the aphasia developed. The psychological studies were made five months after the onset.

The patient's neurological symptoms at this time were much less. His hemiplegia had improved but the right homonymous hemianopsia persisted; the papilledema had decreased, leaving him, however, with a secondary optic atrophy. No sensory disturbances could be demonstrated at this time or had ever been in evidence previously.

Psychological Report

SPEAKING. *Spontaneous speech* was hesitant and incomplete. The boy could not produce many of the words he wanted, and tended to speak in fragments, using slang and colloquial expressions. These had been prominent during the whole two months of the speech difficulty, and were reported to be almost the only phrases used during the periods when speech was most limited. The following conversation was the most extensive at the time of the examination:

> (What do you like in school?) Reading . . . that's too doggone easy . . . (Did you like History?) History, I like that pretty well . . . (Better than Mathematics?) Yeah, I'll say! . . . My father . . . he likes it though . . . I dunno why . . . I wouldn't . . . (Do you do any Manual Training? Do you make things?) It isn't much fun 'cause they take too much . . . they don't have any chance . . . (Too much else to do?) Yeah . . .

Although he did not confuse words or grammatical constructions during the examinations, he was reported to have used incorrect pronouns occasionally, "her" for "him"; to have called the doctors "Mister"; and to have confused other words, as in calling "the snow" "the cold."

His articulation was good, but he sometimes stuttered, repeating the initial sound or syllable of a word several times before he pronounced the word as a whole. This stuttering was reported to have been more severe during the weeks before the examination.

No. 42 occasionally took the correct lip position for the initial sound of a word he could not produce; he did not make the sound.

The patient had practiced counting by ones and by tens and he could count to fifty or sometimes to a hundred correctly, but he was unable to complete other *automatic word series*. He became confused when he tried to say the names of the days of the week and produced only four of them. He could not say any of the names of the months even when prompted by "January." When started with "a," he could say only "a, b, c, d," and further prompting with "e" was not effective.

Naming. No. 42 named only one of a series of nine of the Kuhlmann Line Drawings. He recognized each object, could gesture to indicate its use or occasionally express the use verbally. He could select the correct one of several names presented him, and some of his responses indicated that he had a good understanding of the significance of these names and of their "nearness" to the correct one. When shown a picture of a house, for instance, he could not say the name; he was asked to tell about it and responded as follows:

> You get up sort of . . . oh shucks . . . I'm jus' gonna say it . . . can get inside . . . (Is it a bed?) No . . . (Is it a church?) No . . . pretty near! . . . (Is it an office?) No . . . (Is it a house?) Yes!

He was a little more successful in naming the colors of Head's Test, succeeding in five of sixteen trials. His failures were generally complete inability to respond; only once did he suggest a wrong name and allow it to stand. He could usually select colors to oral command, but made more errors in selecting from the printed name.

Repeating. No. 42 repeated very short sections clearly, but with some difficulty in producing the word-sounds. He had a decided tendency to stutter, frequently repeating the first sound or syllable several times before he pronounced the word as a whole.

Understanding spoken language. The patient followed ordinary conversation fairly well and understood simple questions and directions. He could almost always select the correct one of four pictures to illustrate a given phrase or sentence; his occasional failures, however, showed that he was below normal in his understanding of spoken language (Gates Word, Phrase, and Sentence Reading Test, given orally). He could not follow the more complex directions tests of a spatial nature (Kuhlmann Comprehension, Year VIII, and Abelson Geometrical Figures).

Reading. When No. 42 was asked to read numbers, he almost always tried to count up to the given number, and apparently got the name only as he recognized it in the series. By this system he could identify numbers below ten, but failed all those above. He attempted to read letters in the same way, but actually had to guess at most of them because he could not say the alphabet above "d."

In only six of thirty-two items could he select the correct one of four easy words to represent the accompanying picture (Gates Word Recognition Test). Chance selections should have given him at least as much success, but he actually seemed to recognize one or two of the words.

Writing. The patient could write very little because of his weakness. He succeeded in writing his initials *spontaneously,* and several numbers and letters to dictation. He wrote the numbers below 10 as he had read them, by counting as high as the number. He could not write higher numbers. He wrote several letters *to dictation* correctly in spite of being unable to reach them by saying through the alphabet.

He could not spell words aloud, even after simple demonstrations. He understood the task and could repeat the word but could not produce the individual letters.

ARITHMETIC. No. 42 succeeded only with those simple oral computations requiring the addition of 1 to the given number, as "How much are 3 and 1?" or "How much are 1 and 2?" Here he counted one higher than the larger number and gave the answer correctly and with fair rapidity. He attempted to solve other computations by counting, but could not get the correct answers.

PERFORMANCES ON LANGUAGE INTELLIGENCE TESTS. No. 42 was so severely limited in the production of words that he had little success with the language intelligence tests. He gave only five correct responses to the twenty easy words of the *Oral Opposites Test,* thus falling below the poorest of the normals; and he required considerably more time than the poorest of the normals. His failures were usually complete; he could do no more than repeat the stimulus word. In some few cases he made errors by expressing the "opposite" in a phrase, as "You'd feel good" in response to the word "sick"; or by suggesting the wrong opposite, as "tired" for "happy." The incorrect words he always rejected spontaneously.

Because of his very fragmentary speech, he experienced great difficulty in defining the words of the *Stanford Binet Vocabulary Test.* He sometimes described the use of an object adequately and sometimes indicated the use or the nature of the object by gesture. When all responses showing his recognition of the word were credited, his score ranked him with the ten-year-old child. Actually he probably recognized more words than the ten-year-old, but could find no way of showing his recognition.

REPRODUCTION OF VERBAL MATERIAL. No. 42 could repeat no more than four digits, two letters, two words, or very short phrases and sentences such as "Good morning," "How are you?," "I have a dog." When he attempted slightly longer sequences, he produced the first word or two but was unable to continue.

NON-LANGUAGE PERFORMANCES. No. 42 was too greatly handicapped by weakness to attempt most of the non-language tests. He tried the Porteus Mazes, where speed was not a factor, and after several intervals for rest almost reached the level normal for a boy of his age.

NO. 47. *A case of amnesic disorder with rapid improvement after the draining of an abscess in the left temporal lobe. The boy's mental level had undoubtedly been low before the disorder.*

Male, white, 12; in Grade 4B at school; right handed. An American-born child of Italian parents, who spoke in Italian with his mother and in English with his brothers and sisters; examinations all in English.

Psychological Summary[25]

The first examination just before operation revealed an amnesic aphasia complicated to some extent by disturbances in word-formation. Spontaneous speech was plentiful, but hesitant and fragmentary because the patient could not evoke many of the necessary words. He sometimes substituted "what-you-may-call-'em," or used round-about expressions. At times, particularly when he became confused about an expression, he produced badly misformed words, and the speech deteriorated into almost a jargon. Some of his responses in naming objects, a very difficult performance for him, were garbled words but usually he simply failed to give any name. He was able to select objects to oral command, and to choose from among several names the one appropriate for the object in question. He was not usually satisfied with a name which was only approximately correct, as "bag" for "pocketbook"; he would insist that "they have another one" until the true name was suggested to him. He had less difficulty in naming colors than in naming objects. He could count and give the days of the week quickly and accurately; he could not start the series of months of the year or the alphabet, or complete either when it was started for him. He understood ordinary conversation and all simple questions and directions. He was too much disturbed by the coming operation to be expected to follow complicated directions. His photophobia and visual defects prevented reading and writing tests.

Immediately after the first stage of the operation, although the patient still hesitated for names and used round-about expressions, his speech was greatly improved. In naming, he gave many more correct responses, and his only errors were one or two garbled words and occasional confusions such as "sweater" for "coat" or "ink-pencil" for "pen."

The hesitancy in speaking and the difficulties in naming disappeared rapidly and were rare at the end of a week's time. When these special disturbances had gone, examinations were of little further value as indices of any remaining difficulty for the boy had obviously been dull before the disorder. He was two years retarded in school, and still unable to keep up to his class. Examinations were nevertheless continued during the five weeks after operation to establish his status on tests of intelligence and achievement, and to check on any further improvement. The Stanford Binet mental age was 9 years 4 months in the second week after operation, with an IQ of 78. Performances on reading, spelling and arithmetic tests ranged from 7 years 6 months to 8 years 4 months. The three or four years' retardation in all language performances was probably the result of three factors: the original dullness, the language difficulty resulting from his use of Italian with his parents and English at school, and the aphasic disorder. While it was impossible to estimate the weight of any one of these conditions, it was significant that the boy's performances on non-language tests indicated a higher level of intellectual functioning than those on language tests. His mental age on the Pintner Performance Scale was 11 years, only a year below his chronological age, and his mental age on the Porteus Mazes was up to his chronological age. The superiority of the non-language over the language performances may always have been characteristic, partly as a result of the foreign language complication. The effect of the aphasic disorder on the language performances was probably not an important factor after the first week, for when the specific language disturbances then apparent had disappeared, there was no further improvement.

---

[25] The necessary facts have been included in the Psychological Summary and no detailed Psychological Report is given.

Neurological Summary

The patient was admitted to the Graduate Hospital with a history of running ear on the left side of long duration. Two weeks prior to his admission he began to complain of drowsiness, mental confusion, difficulty in speaking, photophobia, and pain in the eyes. Examination on admission showed a slight weakness of the lower right face, hyperactive reflexes on the right with no Babinski, slow pulse, slight leucocytosis, and a partial aphasia. The pupils were normal in size and reacted normally. The fields were concentrically contracted, but the fundi were normal.

The diagnosis of an abscess in the left temporal lobe was made.

A two-stage operation was performed by Dr. Roberts. The opening was made as is usual in a mastoid operation, and a discharging sinus leading for two inches into the brain tissue was exposed. Pus drained for a period of two or three days and the wound then rapidly healed. A day after the operation all of the aphasic symptoms lessened, and when discharged from the hospital about five weeks after the operation the boy was entirely well. Visual acuity before operation was O.D. 6/12, O.S. 6/12; shortly after operation O.D. 6/30, O.S. 6/30; and later O.D. 6/22, O.S. 6/15.

The lesion was undoubtedly an abscess in the left temporal lobe.

APPENDIX II

TESTS

1. The principal tests of the battery
2. Supplementary tests
3. Shorter batteries

I. THE PRINCIPAL TESTS OF THE BATTERY

Spontaneous Speaking

Records of spontaneous speech. *Speech records* were made as complete as possible and written down *verbatim* and with spelling which would indicate the patient's pronunciation. It was important to have an exact record, even if only one minute of the speech could be taken down at a time, for the content of what the patient said was usually less significant than the word or word-forms and the sentence constructions he used. Additional facts always noted were the inflection and accent of the speech, effort in articulation, hesitancy in producing words and the conditions under which hesitancy occurred, the rate of speaking, and the constancy with which the rate was maintained. Whenever possible the speech records were timed in half-minute or minute periods.

In addition to the spontaneous speech records, the patient's comments on the situation and all forms of *reactive speech responses* were noted. In connection with these it was always necessary to analyze the situation from which the response arose so that it could be interpreted and compared with the less automatic statements.

Automatic word series. The patient was asked to *count,* to name the *days of the week* and the *months of the year,* and to say the *alphabet.* All of these responses were timed to the nearest second, and the interval elapsing before the patient could initiate the series was also recorded. When a patient was unable to begin any series himself, the first or first two or three items were suggested to him. If he halted in the middle and could not continue, he was prompted. All these aids necessarily had to be noted in order to interpret his performance. In some few cases when a patient could neither say any of the automatic word series nor repeat isolated words, he was asked to repeat some of the numbers or the letters of the alphabet after the examiner. In cases where inability to count or say the alphabet possibly depended on difficulty in articulation, the patient was given series of printed or wooden "block" numbers or letters to arrange. The wooden letters used in this research, uncolored and 2½ inches high, were taken from a set of "Educational Letters" for children manufactured by the A. I. Root Company, Medina, Ohio.

In addition to these series the patient was asked to *recite a prayer or a poem* or any material which he had formerly known by heart. If he did not understand the request or said that he knew nothing, several possibilities were suggested to him, usually the Lord's Prayer or "Mary had a little lamb" and other nursery rhymes. Attempts were made to have him join with the examiner in repeating one of these and then continue by himself.[1]

Naming

Head's Tests of Object- and Color-Naming were almost always used in full, often as the initial tests of the series. They were found to be extremely valuable as indices of the patient's ability in naming familiar objects and colors and to serve as preliminary tests for gross disturbances in the understanding of spoken or printed words or in writing. Three minor changes were made in the procedure as Head described it.[2] No screen was used to cover the group of objects or colors on the table. The group was always arranged in the same fashion so as to insure a standard method of presentation: each group, the objects and the colors, was laid out according to the alphabetical order of the names. This system was easy to follow and seemed to the patient to be a random arrangement. The third change in procedure was the substitution of "purple" for "violet" on the Color Test; the former is probably the more familiar word for the American patient. On both object- and color-naming tests not only actual errors but also slight hesitations were noted, and the time between the presentation of the object or color or the command and the patient's response was measured by a stop-watch.

Slighter disturbances in naming often could not be detected by these tests, except perhaps through a slight hesitancy in the patient's responses, and the hesitancy alone did not indicate anything as to the nature of the disturbance. It was therefore necessary to increase the difficulty of the tests. Head's suggestion that geometrical forms, such as a cube, a sphere, a pyramid, etc., be used with educated patients was not suitable for the majority of patients in this group. It is of course difficult to make the naming test a hard enough problem and still keep it within the range of most normal individuals. A series of objects found to be useful included a compass, a flash-light, a tape-measure (a long strip, not the kind which rolls in a case), a stop-watch, a thermometer (not the clinical thermometer), and a fountain-pen.

In most of the cases in this research the slighter disturbances in naming were well shown when the patient attempted to name the line drawings used in the Kuhlmann Revision of the Binet Simon Scale for the Picture Memory Tests at Years III and IV.[3] The drawings represent a greater variety of objects than are included in Head's Test, for example, a bed, a house, a clock, a glove. They are convenient to use, although a series of photographs of objects might be a better substitute for the objects themselves. Experience showed, however, that only one of the drawings, the hat, was likely to be confusing; the others were easily recognized. The drawings were presented to the patient one at a time, in the order in which they were numbered. Again the time required for each response was always determined.[4] When the patient was unable to name the drawing, tests were made to find whether he recognized the name, as shown by his ability to select it from a group of several suggested names. For example, if he failed to name the picture of the house the examiner then suggested a series of words, asking: "Is it a chair?" "A horse?" "An office?" "A church?" etc. In order to analyze the nature of the patient's difficulties words were included in the series which were similar in sound to the true name, as "horse" to "house," and others which were related in meaning or within the same sphere, like "church" and "house."

---

[1] In this connection patients were usually asked to sing a hymn or popular song and observations made as to success in reproducing not only the words but the melody.

[2] Head, *Aphasia and Kindred Disorders,* I, 149–153.

[3] F. Kuhlmann, *A Handbook of Mental Tests* (Baltimore: Warwick and York, 1922), 96, 100. The test material may be obtained from the same publishers.

Repeating

The tests of repeating consisted first of a list of single words containing all English sounds, and second of a series of short familiar phrases and easy sentences. The first part was adapted from Stinchfield's list of words which is based on the International Phonetic System.[5] The particular words of the tests were changed so that all the necessary vowel sounds and the various consonant sounds in their different positions at the beginning, middle, or end of the word would be included in a shorter list and so that as many as possible would be among the most common 500 words according to Thorndike's word list.[6] The test was designed to show any difficulties the patient might have in repeating familiar words or in articulating certain sounds. In many cases the test was given twice, first so that the patient could not see the examiner's lips, and second, so that he could.

Repetition of Single Words

1. hard	behind	what
2. fire	before	if
3. voice	ever	gave
4. third	nothing	month

---

[4] It sometimes happened that the use of a stop-watch annoyed or distracted the patient and was therefore avoided as much as possible. In such cases the examiner made dashes on the paper at the rate of about one per second from the time the picture was presented until the patient answered. Counting or making the dashes at this rate is readily learned by practice with a stop-watch. Making the dashes, which can be counted later, is more satisfactory than counting and taking time to record the number of seconds counted before writing the patient's response.

[5] Blanton-Stinchfield, *Speech Measurement Series* (Chicago: C. H. Stoelting, No. 17022).

[6] Thorndike, *Teacher's Word Book* (2d ed.; New York: Teachers College, Columbia University, 1927).

5. there	brother	smooth
6. see	answer	dress
7. zero	present	use
8. show	washing	fresh
9. child	reaches	watch
10. just	engine	bridge
11. light	color	hall
12. poor	apples	top
13. boy	about	tribe
14. measure	among	warm
15. too	water	great
16. day	body	glad
17. not	until	plain
18. can	across	book
19. give	begin	frog
20. drink	singing	long
21. flower		
22. year	beautiful	true
23. red	carry	hundred

Many patients were also asked to repeat a series of single speech sounds.

The next part of the test, the repeating of familiar phrases and sentences, was unnecessary when the more difficult tests included under the heading of Reproduction of Verbal Material were given.[7] When the patient could not reproduce sentences as long as six or seven syllables, however, he was asked to repeat the shorter phrases or sentences which follow:

Repetition of Familiar Phrases and Sentences

Hello.
How are you?
How do you do?
Are you well?
Goodbye.
Good-morning.
Good-afternoon.
Good-night.
So long.
You're welcome.
All right.
Thank you.
What is it?
What did you say?
What time is it?
Where are you going?
I am late.
Here he comes.

These phrases and sentences are not only short, and so relatively easy for the patient, but they include some of the most familiar expressions of everyday use. Such responses are often produced in reactive speech and it is then interesting to see whether they can be repeated.

---

[7] See pages 589–590.

Understanding Spoken Language

Satisfactory tests for the understanding of spoken language were difficult to arrange; the patient's comprehension had to be judged by his response, but a spoken or written response was unsatisfactory if there were disturbances in expression, and the following of directions unsatisfactory if there were difficulties in movement. Furthermore, tests had to be adequate to show disturbances in the perception of speech as well as in understanding.[8]

A very important part of the study of the patient's understanding consisted in the analysis of his *responses to everyday questions and comments.* It was sometimes observed that he understood questions arising naturally from the situation, even though he did not take his cues from gesture, better than test questions. Some patients also showed fairly adequate comprehension of questions or comments relating to their own particular conditions or interests.

Among the comprehension tests used in this research, the most satisfactory for the detection of serious limitations in understanding were the Gates Word, Phrase, and Sentence Reading Test given orally and the Following of Directions Test described below.[9]

The *Gates Word, Phrase, and Sentence Reading Test* was designed to test reading comprehension in primary school children.[10] Sample sections of the test are reproduced in Figure 28. One form of the test was used in the ordinary way to determine disturbances in reading and the other form was changed into a test of the understanding of spoken language. For this purpose only the four pictures in each item were exposed; the printed material was covered, and the patient was asked to select the correct one of the four pictures to illustrate the word, phrase, or sentence spoken by the examiner.[11] The pictures were not suited to adult interests, but few adults whose understanding was sufficiently limited to require the test objected to its content. The results were particularly interesting because they could be compared with the results from the other form of the test used in the ordinary way, thus making possible a judgment as to the relative extent of difficulties in the understanding of spoken language and printed material. In order to make this comparison fairer the examiner usually repeated the word, phrase, or sentence as often as the patient asked, for on the reading test he could go over the material many times. To determine slighter disorders in understanding, however, the word, phrase, or sentence was repeated only once.

---

[8] It was usually unnecessary to make special tests for the perception of speech sounds, for any existing difficulties of this nature appeared when the results of other tests were analyzed. For example, disturbances in sound perception were indicated when a patient who had no difficulty in articulation made mistakes in repeating single words.

[9] Another form of test is that suggested by Binet and other writers and tried out in this research through a group of 50 *Sensible and Absurd Questions.* These were carefully constructed from the most familiar words in the language, the first 500 according to Thorndike's *Word Book.* For each sensible question an absurd mate was constructed with the idea of providing a check on the patient's responses; the paired sentences were not placed successively in the test. The following samples will illustrate the nature of the sentences:

2. Do flowers grow?
8. Do apples laugh?
10. Do flowers walk?
25. Does a ship cross the sea?
29. Do houses write letters?
38. Are eggs good to eat?
43. Are papers good to eat?

From the point of view of simplicity of response, this should have been a good test for the patient had only to indicate his answer by nodding or shaking his head. Unfortunately, it was a poor test in practice. It failed exactly where it ought to have been most significant, that is, with patients whose understanding was more or less seriously disturbed. Such patients were likely either to answer "yes" or "no" at random, or after the first few items of the test to begin saying either "yes" or "no" to all further questions.

[10] A. I. Gates, *The Improvement of Reading* (New York: Macmillan, 1927), 46–50. Test blanks are published by the Bureau of Publications, Teachers College, Columbia University.

The *Test of Following Directions* included commands such as have been used in most series of tests for aphasia, and a sufficiently large number of items to make the determinations fairly trustworthy.

Test of Following Directions

Close your eyes.
Point to your nose.
Point to your mouth.
Shake my hand.
Make a fist.
Lift your foot.
Knock on the table (bed).
Put your hand on your head.
Tap your finger on your knee.
Lift your arm above your head.

Open your mouth.[12]
Point to your eyes.
Point to your hair.
Wave your hand.
Hit your knee.
Cross your hands.
Stretch out your fingers.
Put your hand over your eyes.
Rub the back of your neck.
Tap your finger on your elbow.

Put your hand over your mouth and close your eyes.
Stretch out your arm and wave your hand.
Put your hand above your head and make a fist.
Lay your hand on the table (bed) and spread your fingers.
Put the back of your hand on the top of your head.

Complicated Commands with Threefold Directions

Test of Three Commissions: putting key on chair, shutting door, and bringing box, Stanford Binet Scale, Year V.[13] (Other directions were substituted in case of paralysis.)

---

[11] In order to cover all but a single row of pictures, a long rectangular slit was cut in the top of a piece of cardboard the size of the test sheet. This slit was made exactly the size of the four pictures, and not large enough to expose the printed material. When the patient had marked or pointed to whichever one of the four pictures he chose to illustrate the first word, the slit was then moved over the next row of pictures, and so on.

[12] If the patient were obviously able to follow easy directions, this second column was often omitted.

Marie's Paper Test: Here are three papers, a big one, a middle-sized one, and a little one. Take the biggest and rumple it up and throw it on the ground. Give me the second. Put the third, the smallest one, in your pocket.

When disturbances in understanding were too slight to appear on any of the above tests, they were evident on some of the language intelligence tests, particularly the Oral Absurdities.[14] They also appeared frequently on some of the tests involving the comprehension of spatial relationships, and these were of course particularly important in cases of spatial disorientation.

Tests Involving the Comprehension of Spatial Terms and Relationships

Test of Right and Left, Stanford Binet Scale, Year VI.[15]

Comprehension Test, Kuhlmann Revision of the Binet Simon Scale, Year VIII.[16]

Head's Hand, Ear, and Eye Test.[17]

Abelson's Geometrical Figures, a series of 17 interlacing geometrical figures which were traced on separate cards from Abelson's drawings, and presented one at a time.[18] In each case the patient had to point to the place indicated by the examiner's command, for example, to point "inside the circle and the triangle but not in the square." The first step in giving the tests was always to make certain, as Abelson directed, that the patient recognized a circle, a square, and a triangle. The median and upper and lower quartiles for the scores of the normal group on this test are presented in Table XXIV (page 577). The test was obviously too easy for these adults, and aphasic difficulties in following the directions were therefore the more significant.

Reading

ORAL READING.[19] The *Gates Graded Word Pronunciation Test* was used to sample the patient's ability to read single words aloud.[20] The 100 words of the test cover a wide range of difficulty; for example, from "so," "we," "an," "is," "do" to "superstition," "affectionate," "substantial," "philosopher," "treacherous." Several alternate forms of the test are available so that re-tests could be made on new material of approximately equivalent difficulty. When the patient showed particular defects in reading these single words, he was asked to name capital and lower-case letters presented in a random arrangement, as on the Gates Test of Phonetic Abilities, or block letters. If a patient showed no great disturbances in reading, both the word pronunciation and the letter-naming tests were omitted and the only study of oral reading was made by the Gray Paragraphs.

---

[13] L. M. Terman, *The Measurement of Intelligence* (Boston: Houghton Mifflin Company, 1916), 172–173.

[14] See pages 587–588.

[15] Terman, *op. cit.,* 175–178.

[16] Kuhlmann, *op. cit.,* 114. The material of this test, sheets of paper on which are six one-inch squares each with a dot in the center, may be obtained from Warwick and York, Baltimore. The subject is directed on the first square to draw a line "from the center to the upper left hand corner," on the second square "from the center to the middle of the left side," and so forth.

[17] Head, *op. cit.,* 157–161.

[18] A. R. Abelson, *The Measurement of Mental Ability of Backward Children,* Brit. J. Psychol., 1911, 4, 268–314. All the figures were drawn in black ink.

[19] When reading was extremely defective, the Gates Tests of Visual Perception were usually given to determine how well the patient recognized slight differences between series of figures, numbers, and words. See Supplementary Tests, page 595.

The *Gray Oral Reading Paragraphs* were valuable for almost all the patients.[21] Of the four sets, the first contains 50 words and is very easy reading; the second, third, and fourth contain 150 words each and are of increasingly greater difficulty. There are several forms of each set, so that the patient could be re-tested on different material of approximately equal difficulty. All the forms of Set I are naturally very childish but Set II, No. 2, Set III, Nos. 2, 4, and 5, and any form of Set IV were found to be suitable in content for use with adults. The time was recorded in number of seconds and the errors noted exactly; in addition observations were made of any monotony or unnatural accent or phrasing, or of any difficulty in following the sequence of words.[22]

For the adults of the normal group time and error scores were combined by adding to the time score one-fiftieth of the total time for each error. Unfortunately these adults were given the set or sets suitable to their reading level and not all of them attempted any one set. Standard errors of estimate were too high to estimate the score on one set from that on another (26.16 for IV estimated from III, and 9.16 for III estimated from IV). Five of the 68 patients tested read only Set I or Set II. The large majority of them, 57 in all, attempted Set IV, and the scores for Set IV were therefore the best indices of the normal performances. The median and quartiles were: median 71.5, upper quartile 58.4, lower quartile 89.5. It must be remembered, however, that the scores for the ten patients able to read but still considered too poor to attempt Set IV would have lowered these figures slightly.

Reading comprehension. The oral reading tests were graded in difficulty so that they could be used with all degrees of disturbance. The tests of reading comprehension, however, had to be selected according to the degree of the defect. If it were severe, the Gates Word Recognition and Word, Phrase, and Sentence Reading Tests were used.[23] The *Word Recognition Test* contains 48 items, each composed of a picture and four easy words. The patient must find which of these represents the picture. For most cases the *Word, Phrase, and Sentence Reading Test* was found to be the better when only one of the two tests was to be given. It contains 35 items, each of them consisting of a word,

---

[20] Gates, *op. cit.*, 135–136; test sheets published by Bureau of Publications, Teachers College, Columbia University.

[21] Public School Publishing Company, Bloomington, Illinois.

[22] If the patient had a tendency to reverse letters like "b" or "p" or letter sequences, tests for the oral reading of reversed print were often given. The ordinary paragraphs were held before a mirror so that the patient read from the mirror image, or special forms in reversed print were used. Dr. S. T. Orton very kindly lent the authors a set of the reversed forms which he used in connection with his cases of reading difficulty.

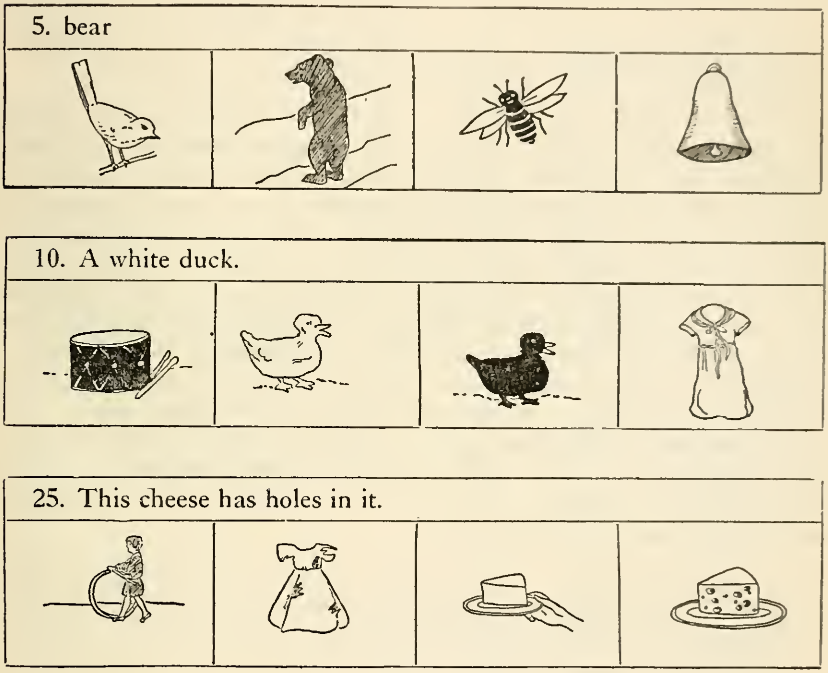

5. bear
10. A white duck.
25. This cheese has holes in it.

Figure 28. Sample items from Gates Word, Phrase, and Sentence Reading Test, Form 1

phrase, or sentence printed above a row of four pictures, as in the samples in Figure 28, above. The patient must select that one of the four pictures which best illustrates the printed material. The test was arranged for silent reading but many patients read the material aloud and commented on it, often making possible an analysis of their errors.

---

[23] Gates, *op. cit.*, 43–50. Tests published by the Bureau of Publications, Teachers College, Columbia University.

In this research the *Pintner Toops Revised Directions Test* (C. H. Stoelting, Chicago) was also used in severe cases, but usually only as a preliminary index. In connection with some items it was difficult to tell whether the patient had followed directions because he read them understandingly or whether he guessed the response from the picture or figure.

Two more difficult reading tests were used extensively: the Chapman Unspeeded Reading-Comprehension Test and the Thorndike McCall Reading Scale. The choice depended on the nature of the patient's difficulties. The *Chapman Unspeeded Reading-Comprehension Test* is a series of 31 paragraphs each containing an incongruous word in the second half of the paragraph which the patient must detect.[24] For example, one of the paragraphs is:

> 2. We have a large dog at our home in the country. Whenever we come back after being away, he purrs to show how pleased he is.

The particular advantage of this test was that it required no spoken or written responses, and so could be used even in cases where expression was greatly disturbed. It was fairly satisfactory for both aphasic and normal patients from the point of view of content. No time limits were set for either group; the aphasic patients sometimes required longer than the normal even though they could not solve so many items of the test. The median and quartiles of the normal scores are given in Table XXIV, page 577. For the normal group this test correlated highly with various language intelligence tests, indicating that the detection of the incongruous word in the paragraph was a good index of intelligence. It also showed a high correlation with the Thorndike McCall Reading Scale: +.81 ±.05 for the white patients of the normal group.

The *Thorndike McCall Reading Scale* was found to be satisfactory in cases where expression was not seriously disturbed.[25] The test is composed of a series of paragraphs with questions on each which the patient must answer; for example, the first section of Form 1 is:

> On Monday Dick saw a red fox, a gray squirrel and a black snake in the woods. The next day he saw a brown rabbit and five brown mice in the field. He killed the fox and all the mice but let the others live.
> 1. What was the name of the boy who saw the mice?....................
> 2. On what day did he see the mice?.................................
> 3. What color was the fox?..

Like the Chapman Reading-Comprehension Test, the Scale includes difficult as well as fairly simple material and was suitable in cases of both slight and more severe reading disturbances. The median and quartiles for the scores of the normal group are presented in Table XXIV. The normal patients required 20 to 30 minutes to finish as much of the test as they could do; aphasic patients were often allowed to work longer but rarely accomplished more in the extra time.

---

[24] Published by J. B. Lippincott Company, Philadelphia.

[25] Published by Teachers College, Columbia University. Several alternate forms are available.

TABLE XXIV

MEDIANS AND QUARTILES OF SCORES FOR THE GROUP OF NORMAL SUBJECTS

	MEDIAN	UPPER QUARTILE	LOWER QUARTILE	NUMBER OF CASES
UNDERSTANDING SPOKEN LANGUAGE				
Abelson Geometrical Figures Test .	17.1	17.8	15.8	34
READING				
Chapman Unspeeded Reading-Comprehension Test	17.2	21.3	12.1	51
Thorndike McCall Reading Scale .	24.4	28.3	21.3	69
WRITING AND SPELLING				
Morrison McCall Spelling Scale .	39.8	46.5	33.8	72
Stanford Dictation Test (New Form W)	89.3	107.7	76.0	70
Gates Oral Spelling Test . . .	26.6	31.2	21.1	65
ARITHMETIC				
Stanford Computation Test . .	25.4	29.9	21.5	66
Stanford Reasoning Test . . .	21.9	26.7	18.4	64
LANGUAGE INTELLIGENCE TESTS				
Oral Opposites, Score	18.0	19.4	16.2	79
Oral Opposites, Speed	70.6	54.8	91.3	79
Printed Opposites, Score . . .	16.9	18.5	14.6	62
Printed Opposites, Speed . . .	76.7	57.5	100.8	62
Part-Whole, Score	16.0	18.0	14.9	45
Part-Whole, Speed	91.0	73.5	107.2	45
Oral Analogies	21.8	25.5	15.1	55
Printed Analogies	21.4	26.9	16.4	70
Sentence Completion	7.9	8.6	7.1	67
Oral Absurdities	7.2	8.2	4.6	58
Printed Absurdities	7.8	9.3	6.2	51
Oral Vocabulary: Stanford Binet .	52.6	62.3	42.5	83
Printed Vocabulary: Thorndike Test of Word Knowledge	63.9	75.2	43.0	60
NON-LANGUAGE TESTS				
Pintner Paterson Performance Scale				
Mare and Foal, Error Score . .	0.8	0.1	1.8	57
Mare and Foal, Time Score . .	27.0	21.6	39.0	57
Seguin	15.5	12.5	18.6	53
Two-Figure Board, Move Score .	11.1	9.5	14.4	57
Two-Figure Board, Time Score .	31.5	23.6	59.5	57
Casuist Board, Error Score . .	3.9	1.9	7.9	57

TABLE XXIV (*cont.*)

	MEDIAN	UPPER QUARTILE	LOWER QUARTILE	NUMBER OF CASES
Casuist Board, Time Score	62.0	46.9	101.2	57
Healy A Puzzle, Move Score	9.6	6.5	14.4	57
Healy A Puzzle, Time Score	30.8	20.1	51.5	57
Feature Profile	102.0	67.1	184.8	57
Ship Test	19.6	20.0	17.7	57
Picture Completion	511.5	638.0	416.8	57
Substitution Test	102.8	82.8	123.8	53
Knox Cube	7.4	9.9	6.4	40
Pintner Non-Language Mental Test	346.7	412.5	278.6	68
Imitation (raw score)	6.4	8.3	4.0	68
Easy Learning (raw score)	39.1	47.1	28.5	68
Hard Learning (raw score)	33.3	42.0	25.6	68
Drawing Completion (raw score)	12.8	15.4	10.8	68
Reversed Drawing (raw score)	5.0	6.8	3.8	68
Picture Reconstruction (raw score)	12.2	15.7	7.7	68
Drawing of a chair	16.8	19.4	13.0	35
Drawing of a man, Goodenough Scale	27.0	35.0	20.6	64

Writing

SPONTANEOUS WRITING. Samples of *spontaneous writing* were obtained whenever possible. According to the patient's ability they sometimes consisted only of his name or a part of it, sometimes of long letters and reports. Whenever the products were sufficiently extensive, they were analyzed for errors in the formation of letters, mistakes in spelling and defects in the formation of the word, verbal confusions, grammatical errors, and structural changes in the sentence. In addition the material was studied not only for the particular content, but for any tendency to repeat, to lose the thread of the narrative, or to become incoherent.

WRITING TO DICTATION. Two dictation tests were used: the Morrison McCall Scale and the New Stanford Achievement Dictation Test. The former was more valuable in cases of extensive disturbance in writing or in understanding spoken language, the latter in cases of slighter disturbance. The correlation between the two tests was high for the white patients of the normal group: +.88 ±.02. The *Morrison McCall Spelling Scale* consists of eight lists with 50 words of graded difficulty in each.[26] The lists are supposed to be roughly comparable, so that different ones may be used on re-tests. The first words in each list are very simple, for example, "run," "top," "red," "book," but the scale as a whole was difficult enough to be a satisfactory test for most aphasic patients. It was not difficult enough for many of the normal adults, however, and the distribution for the normal group was poor. The median and quartiles are given in Table XXIV. For the normal white subjects, the reliability was high, +.94 ±.01 as determined by the correlation of alternate items of List 1. In using the test with the normal adults, the author's directions were followed; that is, the word was pronounced, read in a sentence, and pronounced again. Some of the aphasic patients who had difficulty in understanding were confused by hearing the sentence, and the test word was therefore dictated alone.

The *New Stanford Achievement Dictation Test* made a satisfactory index of ability to write to dictation in all cases of moderate or slight disturbances.[27] Form W was always used as the first test, Forms V and X if further tests were needed. The sentences were repeated if the patient asked to have them repeated. The normal distributions were fairly satisfactory; medians and quartiles are shown in Table XXIV.

The spelling errors made by the normal patients on the Stanford Dictation Test were analyzed and assigned to the following groups:

Substitutions	42.2 per cent
Omissions	36.7 per cent
Additions	8.7 per cent
Reversals	3.3 per cent
Repetitions	3.1 per cent
Unclassified	6.4 per cent

Each group was further analyzed into letter, syllable, and word errors but the percentages in these subgroups were not of particular significance; letter errors were always more frequent than syllable or total word errors. A further differentiation was made to determine the percentage of the errors which was phonetically justifiable; this was 11.5 for the normal group. A similar analysis was then made in each case of aphasia to determine whether the errors differed markedly from the normal.

Oral spelling. An oral spelling test was frequently valuable, especially for patients who had difficulty either in writing or in producing and articulating words. The Gates list of 36 words of graded difficulty was used.[28] The scoring was changed to the total number correct on the first attempt or corrected spontaneously by the patient. The normal median and quartiles are given in Table

---

[26] *Morrison McCall Spelling Scale* (Yonkers, New York: World Book Company).

[27] A sample set of the *New Stanford Achievement Test,* containing the Dictation Tests V, W, and X, may be obtained from the World Book Company, Yonkers, New York.

[28] Gates, *op. cit.,* 387–388.

XXIV. For the white patients of the normal group the correlations between this and the dictation tests were high: Oral Spelling—Morrison McCall +.89 ±.02; Oral Spelling—Stanford Dictation +.90 ±.02. For the aphasic patients records were made not only of the errors but of the manner in which words were spelled; that is, how many attacks the patient made on the word and what these were, whether he divided the word into syllables, how rapid his responses were, and how quickly he spelled the word.

Copying. An index of ability to copy single words was usually obtained in the early part of each study from the results of Head's Object- and Color-Naming Tests. If there were great difficulties in copying single words, the patient was asked to copy a random assortment of single letters, his own name, and easy words such as "cat." If he copied the names of the objects and colors fairly well, however, he was given the following paragraph, borrowed from the Thorndike McCall Reading Scale:

> *EVERY HOME NEEDS A GARDEN*
>
> A magazine published to promote real gardening. Most people do not think much about their gardens at this time of the year, but if more people did, there would be more good gardens. If you live in the city where space is at a premium, we provide pleasure for you by suggesting how to grow flowers indoors. If you live in the country and have a garden and do not experience the satisfaction of seeing things grow as a result of your own efforts—then you need the X.Y.Z. magazine.

The average number of words copied per minute by the normal person was 4.2 and the average number of errors for the total section (with uncrossed "t's" and undotted "i's" counted as ¼ error) was 6.1. The rate and accuracy were computed for each aphasic patient and compared with these figures.

Arithmetic

The arithmetic tests most frequently used were the two parts of the Stanford Achievement Arithmetic Examination, Computation and Reasoning.[29] These tests were usually sufficient, but in cases where there were severe or particularly interesting difficulties in arithmetic some of the tests included in the "Number Study" had to be used.[30]

The *Stanford Computation Test* is made up of an assortment of problems in the four arithmetical processes and includes computations involving fractions and decimals. The median and quartiles for the normal group are given in Table XXIV.

The *Stanford Reasoning Test* includes a series of arithmetical problems of graded difficulty. Table XXIV shows the normal median and quartiles. In cases where reading was difficult or where a comparison between the understanding of printed and oral questions was desired, Form B of the Reasoning Test was read aloud to the patient, Form A being reserved for use as a printed test.

---

[29] Published by the World Book Company, Yonkers, New York.

[30] See Supplementary Tests, pages 596 ff.

Language Intelligence Tests

The tests of this group were not given in cases where language processes were extremely limited or confused. They were particularly important in cases where language as a whole or one or more forms of language were only slightly affected.

CONTROLLED ASSOCIATION TESTS. Several varieties of controlled association test were used: opposites, part-whole, and mixed analogies. Separate groups of both opposites and analogies were prepared for presentation orally and in print, so that cases with marked disturbances either in the understanding of spoken language or in reading could still be examined, and so that determinations could be made of the relative extent of the disturbances in these two processes.

The *Oral Opposites Test* adopted was Whipple's List 4.[31] It is composed of twenty fairly easy stimulus words.

Oral Opposites Test

1. good
2. outside
3. quick
4. tall
5. big
6. loud
7. white
8. light
9. happy
10. false
11. like
12. rich
13. sick
14. glad
15. thin
16. empty
17. war
18. many
19. above
20. friend

The following directions are given:

> I am going to say a word and I want you to tell me the *opposite* of it as quickly as you can. For instance, if I say "long," you say the opposite, "short." Can you tell me the opposite of "north"? (If the patient could not, he was told. "Soft" and "hard" were then used as a third illustration. Whenever necessary each illustration was accompanied by gestures or a demonstration.)

The test was then begun by the question, "What is the opposite of 'good'?" The remaining stimulus words were given singly and as rapidly as the patient could respond. When he gave no response in 10 seconds, the next stimulus word was presented. This rule was originally made so that a large proportion of the time would not be spent on one response, but it could not always be carried out for some patients refused to give up the attempt in 10 seconds. The test was scored in terms of total number of responses correct and total time required.[32] The words were too easy for the normal patients, and their scores in terms of total number of responses correct distributed badly. Their time scores gave a better distribution. Medians and quartiles are shown in Table XXIV.

---

[31] G. M. Whipple, *Manual of Mental and Physical Tests,* Part 2 (3d ed.; Baltimore: Warwick and York, 1921), 79–80.

The *Printed Opposites Test* was specially constructed, and the words chosen to be of approximately equivalent difficulty to those of the Oral Opposites Test. For each word of the Oral List one of the same difficulty value for the adult according to the findings of King and Gold was chosen for the Printed List.[33] The adults examined by these investigators were superior, however. The two lists as presented were not found to be of equivalent difficulty for the average adults of the normal group. As the medians and quartiles in Table XXIV show, the Printed List was the more difficult. For the white patients of the normal group, the correlations between the two tests were: scores in terms of number correct, +.62 ±.06; in terms of time, +.52 ±.07.

Printed Opposites Test

1. heavy
2. backwards
3. up
4. beginning
5. tender
6. first
7. sour
8. straight
9. timid
10. stale
11. simple
12. high
13. refined
14. raise
15. absent
16. sharp
17. winter
18. near
19. forget
20. day

When both oral and printed tests were given, the printed was given second and with no further instructions. When the printed was given alone, it was preceded by instructions like those given above for the Oral Test but presented in print. The patient read the test words, silently or aloud as he preferred, and gave the response orally. He was sent on to the next word if he had not responded within ten seconds.

The Part-Whole Test was satisfactory as a more difficult test of controlled association.[34]

---

[32] No partial credits were given on this or the Printed Opposites Test.

[33] I. King and H. Gold, *A Tentative Standardization of Certain "Opposites Tests,"* J. Educ. Psychol., 1916, 7, 459–482.

[34] The words used were those of Pyle's test; see W. Healy, A. Bronner, *et al., A Manual of Individual Mental Tests and Testing* (Boston: Little Brown, 1927), 49.

Part-Whole Test

1. window
2. leaf
3. pillow
4. button
5. nose
6. smokestack
7. cogwheel
8. cover
9. letter
10. petal
11. page
12. cob
13. axle
14. lever
15. blade
16. sail
17. coach
18. cylinder
19. beak
20. stamen

The directions used were as follows:

> I am going to tell you some words, one at a time. Each of them means a part of something. As soon as I've said a word, I want you quickly to tell me the word meaning the whole of which the word I said is a part. For instance, if I said "wheel," you could say "engine." If I said "toe," what word could you say? (If the patient did not answer correctly, he was told "foot," the "toe-foot" relationship was demonstrated and the directions were repeated.)

The test was scored in terms of total number of items correct and total time required.[35] Both of these scores gave better distributions for the normal group than the scores on either of the Opposites Tests; the time scores for the Part-Whole formed an excellent distribution. Medians and quartiles are shown in Table XXIV. The Opposites Tests, however, being simpler than the Part-Whole, were usually more valuable for aphasic patients.

Two forms of the Van Wagenen Graded Analogies Test formed the basis for the Oral and Printed Analogies Tests, B for the oral and A for the printed.[36] Each form contained 50 analogies. On the basis of the results for the normal group the number in each form was cut to 35, with the elimination of items which had been confusing to some patients or had contained unfamiliar words, and of all but one of any items of the same difficulty value. The two abbreviated lists were closely comparable in difficulty. The medians and quartiles for the normal group are given in Table XXIV. The correlation between the two tests was +.82 ±.03 for the normal white patients.

The *Oral Analogies Test* proved to be an efficient means of detecting slight difficulties in evoking words. The 35 items were arranged in order of difficulty for the normal group.

---

[35] No partial credits were assigned.

[36] M. J. Van Wagenen, *Graded Opposites and Analogies Tests,* J. Educ. Psychol., 1920, 11, 241–263.

Oral Analogies Test

1. horn is to blow as bell is to ——? (ring, clamor)
2. rain is to summer as snow is to ——? (winter)
3. vinegar is to sour as sugar is to ——? (sweet)
4. work is to day as sleep is to ——? (night)
5. baker is to bread as bees are to ——? (honey)
6. rug is to floor as pictures are to ——? (wall)
7. iron is to heavy as aluminum is to ——? (light)
8. year is to month as week is to ——? (day)
9. high is to low as near is to ——? (far)
10. stove is to heat as lamp is to ——? (light)
11. raise is to lower as open is to ——? (shut)
12. eat is to food as wear is to ——? (clothes)
13. country is to road as city is to ——? (street)
14. under is to over as down is to ——? (up)
15. navy is to sailors as army is to ——? (soldiers)
16. foot is to leg as hand is to ——? (arm)
17. sweet is to taste as red is to ——? (color)
18. silver is to tarnish as iron is to ——? (rust)
19. front is to back as top is to ——? (bottom)
20. hard is to soft as rough is to ——? (smooth)
21. triangle is to three as square is to ——? (four)
22. fair is to cloudy as sunshine is to ——? (rain)
23. fruit is to basket as water is to ——? (pail, bucket, bottle, pitcher)
24. box is to wood as bottle is to ——? (glass)
25. wall is to paper as floor is to ——? (carpet, rug, paint, varnish, stain)
26. coal is to black as gold is to ——? (yellow)
27. foot is to ankle as hand is to ——? (wrist)
28. man is to legs as carriage is to ——? (wheels)
29. leg is to knee as arm is to ——? (elbow)
30. kettle is to utensil as chair is to ——? (furniture)
31. park is to gate as house is to ——? (door)
32. knife is to blade as fork is to ——? (tine, prong, points)
33. number is to figures as word is to ——? (letters)
34. grain is to wheat as fruit is to ——? (any kind of fruit)
35. house is to door as field is to ——? (gate)

The instructions were approximately the same as those outlined by Van Wagenen, except that the patient was asked to give his response orally:

> I am going to say three words. I want you to tell me a fourth word that has the same relation to the third word I say as the second has to the first. Here's an example: *color* is to *red* as *name* is to — *John*. Here's another: *page* is to *book* as *handle* is to — *knife*. See if you can tell me the fourth word for this

one: *chew* is to *teeth* as *smell* is to —? (If the patient could not tell the fourth word, it was told him, and the directions were given again.)

The successive items of the test were then read aloud. The patient's responses were timed but only as an aid to analyzing the relative difficulty with different items. The score was taken as the total number of correct responses.[37] The distribution of scores for the normal group was only moderately satisfactory. The median and quartiles appear in Table XXIV.

If both oral and printed tests were used, the latter was given second and with no further instructions except that the patient was asked to read the words instead of listening to them. He responded orally. If the Printed Analogies were used alone, printed directions were given, and for convenience these were placed at the top of the test sheet. The items were arranged in order of difficulty for the normal group.

Printed Analogies Test

Write a fourth word that has the same relation to the third word in the row that the second word has to the first word in the row. Here are two examples:

color red name JOHN
page book handle KNIFE

Can you name the fourth word here?

chew teeth smell ——

1. birds fly fish —— (swim)
2. summer hot winter —— (cold)
3. light day dark —— (night)
4. sun shines wind —— (blows)
5. father son mother —— (daughter)
6. hat head shoe —— (foot)
7. barn hay library —— (books)
8. cup saucer knife —— (fork)
9. cats scratch bees —— (sting)
10. food eat books —— (read)
11. hair black eyes —— (blue, black, brown, etc.)
12. man husband woman —— (wife)
13. thermometer temperature clock —— (time)
14. clothes tear dishes —— (break)
15. water drink air —— (breathe)
16. lamp oil stove —— (coal, fuel, wood)
17. happy laugh sad —— (cry, weep)
18. potato vegetable veal —— (meat)
19. far near there —— (here)
20. sparrow bird mosquito —— (insect, bug)

---

[37] No partial credit was allowed. The correct answer or answers are given in parentheses after each item.

21. bread flour candy —— (sugar, molasses)
22. city mayor state —— (governor)
23. water glass coffee —— (cup)
24. sight blind hearing —— (deaf)
25. July month Friday —— (day)
26. slipper shoe cap —— (hat)
27. cheap many costly —— (few)
28. air birds water —— (fish)
29. complex difficult simple —— (easy)
30. month week day —— (hour)
31. present known future —— (unknown)
32. mail write telephone —— (talk)
33. picture frame field —— (fence)
34. victory defeat success —— (failure)
35. work problems play —— (games)

Sentence completion test. The *Kelley-Trabue Sentence Completion Test* was used in all cases where reading was sufficiently well preserved so that the test would not be simply an index of reading ability. It was very valuable in estimating deterioration in language. Form Beta was used for the normal group and as the initial test in all the pathological cases; Alpha was used for some of the re-tests for aphasic cases.[38] The 40 sentences of the test cover a wide range of difficulty; the first five were easy enough for patients with severe disturbances to attempt:

1. I see you. Can you see ——?
2. The boy has —— book.
3. I —— to school each day.
4. Men —— older than boys.
5. I see —— man and the boy.

The sentences become increasingly longer and the problem of completing them more difficult. Samples from the upper end of the scale are:

30. When two persons —— about —— which neither ——, they —— almost —— to disagree.
35. —— that are —— to one by an —— friend should be pardoned —— readily than injuries done by one —— is not angry.

---

[38] When the study was begun both these forms could be obtained from the Bureau of Publications, Teachers College, Columbia University. Shortly afterward the supply was exhausted and, with Professor Trabue's permission, the tests were multigraphed. They may, however, be obtained from C. H. Stoelting, Chicago.

The scoring system used was that devised by the authors. See Kelley, *Individual Testing with Completion Test Exercises,* Teach. Coll. Rec., 1917, 18, 371–382; M. R. Trabue, *Completion-Test Language Scales* (New York: Teachers College Contributions to Education, No. 77, 1916).

40. The least difficult —— are by no —— always the most ——, —— are the —— tasks —— the most disagreeable.

The test was difficult enough to be suitable for the adults of the normal group, and the distribution of normal scores was one of the most satisfactory obtained. Table XXIV shows the median and the quartiles.

Absurdities tests. A large number of "absurdities" were collected, chiefly from among those suggested by Ballard.[39] These were divided into two groups by selecting alternate items; one group was then presented orally and the other in print. The responses made by the normal subjects were scored by the three psychologists working together; the items most confusing to the subjects or most difficult to score were eliminated and each group cut to 11 paragraphs. The score values arranged for the normal responses were used for the pathological.[40] The tests were promising for the normal group, but should probably be lengthened. The distributions were poor. Medians and quartiles are given in Table XXIV. The correlation between Oral and Printed Tests for the white patients of the normal group was +.67 ±.09.

Oral Absurdities Test

1. A man asked a boy where Mr. Smith lived. He said: "The first house you come to is a barn and the next is a haystack—the next is Mr. Smith's."
2. A gentleman fell from his carriage and broke his neck, but received no further damage.
3. The judge said to the prisoner: "You are to be hanged, and I hope this will be a warning to you."
4. When there is a collision the last car of the train is usually damaged most, so the guard thinks it would be best if the last car were always taken off before the train starts.
5. A boy wrote on his composition: "Soap smells nice, but it tastes horrid. It tastes worst of all when you get it in your eye."
6. An old gentleman complained that he could no longer walk around the park as he used to; he could now go only halfway round and back again.
7. A householder saw an advertisement: "Buy one of Simkin's stoves and save half your coal." He bought two in order to save all of it.
8. I am not conceited, but I don't think I'm half as clever as I really am.
9. You are thin and I am thin, but he is thinner than both of us put together.
10. A showman advertised for a giant and a dwarf. A man of ordinary height presented himself and offered to fill both parts. He claimed to be the smallest giant in the world and the biggest dwarf.
11. Every rule, even this one, has an exception.

---

[39] P. B. Ballard, *The Limit of Growth of Intelligence*, Brit. J. Psychol., Gen. Sec., 1921, 12, 125–141.

[40] Weisenburg, Roe, and McBride, *Adult Intelligence*, Appendix (The Commonwealth Fund).

The following directions were used in giving the Oral Test:

> I am going to read you a paragraph that has something foolish about it, something absurd. When I've finished, I want you to tell me what is foolish about it. What is foolish about this sentence? "A soldier in the march complained that every man was out of step except himself." (If the patient could not indicate the absurdity, it was explained to him.)

If the Printed Test were given later, no further directions were added. For convenience in cases where the Printed Test alone was used, similar directions were inserted at the top of the printed page.

Printed Absurdities Test

Read this sentence and decide what is foolish about it.

> A soldier in the march complained that every man was out of step except himself.

What is foolish about each of these paragraphs?

1. I like end slices of bread. I gave the girl a whole loaf of bread and told her to bring me the two end slices. I afterward found that she had sliced the entire loaf. I asked her why she did this. She said: "How could I get the second end piece unless I did?"
2. I received a letter from a friend in which he said: "If you don't get this letter, just let me know and I'll write again."
3. I read in the paper that they fired two shots at a man. The first shot killed him but the second one didn't.
4. This morning I met a smart young man. He was walking down the street with his hands in his pockets and twirling a brand new walking stick.
5. An Irishman called one day at the post office and asked if there was a letter waiting for him. "What is your name?" asked the postmaster. "Sure," said the man, "you will find my name on the envelope."
6. It is said that a certain town in Greece contains two relics of Saint Paul: one his skull when he was a boy and the other his skull when he was a man.
7. A teacher said to his boys: "Tomorrow we will have an examination, attendance at which is voluntary; so if any boy is absent he'd better look out."
8. A man said to his shoemaker: "You blockhead! I told you to make one of these shoes larger than the other, and instead of that you made one of them smaller than the other."
9. There is a tree in America so tall that it takes two men and a boy to see the top.
10. The three men laughed, then stopped suddenly as the eyes of each met those of the others across the table.
11. The horse obeys his master because his eyes magnify so that his master seems to the horse to be much larger than the horse himself.

VOCABULARY. Two vocabulary tests were used: the list of words from the Stanford Binet Scale and the Thorndike Test of Word Knowledge. The *Stanford Binet Vocabulary Test* was given and scored according to the Stanford directions; each word was pronounced for the patient as many times as necessary, and he had then to give some oral definition that would indicate that he recognized its meaning.[41] The scoring is such that even aphasic patients with considerable difficulty in expression could be credited as having indicated their knowledge of a large number of word meanings. The test was valuable for both pathological and normal groups. Table XXIV shows the normal median and quartiles.

The *Thorndike Test of Word Knowledge* presented a different problem: instead of suggesting the definition orally, the patient had to mark that one of five given words synonymous with the test word.[42] In spite of the differences in nature, the two vocabulary tests correlated +.88 ±.02 for the white patients of the normal group. The normal median and quartiles are given in Table XXIV. Form D of the Test of Word Knowledge was used for the normals and as the first test for the aphasic patients. If a re-test were given, Form A was used. Several examples from Form D are:

5. avenue 1 justice...2 arrival...3 street...4 jury...5 library
10. concern 1 see clearly...2 engage...3 furnish...4 disturb...5 have to do with
15. bade 1 gaze...2 a tool...3 fetched...4 wait...5 ordered

Reproduction of Verbal Material

IMMEDIATE MEMORY FOR DIGITS, LETTERS, AND DISCONNECTED WORDS. The number, letter, and word series used were taken from the Gates Diagnostic Reading Tests.[43] The items in the series were presented orally at the rate of about one per second. The median numbers in each series repeated by the patients of the normal group were: 7 digits; 6 letters; 5 disconnected words. In order to compare the results of auditory and visual presentation for the digits and letters, cards containing the auditory series printed in reverse order were prepared.[44] These cards were exposed for as many seconds as there were numbers or letters on the card. Unless there was greater difficulty in speaking than in writing, the patient repeated the series aloud. With the visual presentation, the medians for the normal group were 7 digits and 7 letters.

---

[41] Terman, *op. cit.*, 224–231.

[42] Tests published by Bureau of Publications, Teachers College, Columbia University. In the test as printed the five words from which the subject must choose the synonym are numbered, and the answer is recorded by writing the number of the synonym at the far right-hand side of the page. The method was simplified in the case of the aphasic patients, who were told to disregard the numbers and draw a line under the word that "meant the same thing as the first word in the row."

[43] Gates, *op. cit.*, 402–403.

[44] The letters were 1¼ inch lower case letters; the numbers were 1⅛ inch black figures obtained from the Tablet and Ticket Co., New York.

Immediate reproduction of sentences. The sentences used were those of the Stanford Binet Scale, varying in length from 6 or 7 to 28 syllables, and the Stanford method of presentation was followed.[45] Two additional sentences were selected from the Kuhlmann Revision of the Binet Simon Scale.[46] The results for the normal group showed 100 per cent repeating the Stanford sentences, 16–18 syllables; 85 per cent repeating 20–22 syllables; and only 20 per cent repeating 28 syllables. The test was interesting for the aphasic patient not only as a memory test, but for the errors and confusions which often appeared on the longer sections.

Reproduction of a short story. The *Auditory Verbal Memory Test* was read aloud to the patient three times and he was then asked to repeat.[47] It is a short passage of 82 words about a shipwrecked sailor:

If a sailor
on the ocean
is shipwrecked
in a wild country
he must first look for water to drink
then he must find a place to sleep
where wild animals won't get at him
and after that he can take time to look for food
but he must be careful not to eat poisonous berries or fruit
next he had better hunt for other people on the land
and put up a flag
to stop ships which may be going by.

In many cases of aphasia the test was not so much an index of the amount of verbal material which could be reproduced as of the disturbances in expression.

Non-Language Tests

Tests from the Pintner Paterson Performance Scale.[48] In general the tests of the Pintner Paterson Performance Scale were not difficult enough for the adults of the normal group. Medians and quartiles are shown in Table XXIV. The most nearly satisfactory distributions were obtained on the Mare and Foal, the Seguin, the Feature Profile, the Substitution, and the Knox Cube Tests.

The tests proved to be sufficiently difficult for almost all the aphasic patients, and were extremely valuable as means of estimating intelligent behavior in non-verbal situations. The reliability of the tests in use with aphasic patients could not be determined, but it was clear that several formboards should always be used to make an estimation, preferably the Seguin, the Two-Figure Board, and the Casuist Board. The Healy A Puzzle was also given to the patients in this research, but unexpectedly high scores in some cases where all other performances were undeniably poor seemed to cast doubt on its value. Close observations of the performances on all the formboards were made and recorded so as to analyze the nature of the difficulties.

---

[45] Terman, *op. cit.*, 149–150; 160; 185–186; 277–278; 332–333.

[46] Kuhlmann, *op. cit.*, 96, sentence b; 130, sentence b.

[47] Healy, Bronner, *et al.*, *op. cit.*, 65.

[48] R. Pintner and D. G. Paterson, *A Scale of Performance Tests* (New York: Appleton, 1917).

The Manikin and the Feature Profile were also found to be worth while for aphasic patients, the former in cases of extensive and the latter in cases of slight deterioration. The picture tests, with the possible exception of the Mare and Foal which is partly a formboard, were usually more difficult than the formboards for the aphasic patients. Those with serious disturbances apparently paid no attention to the pictorial content of the Ship Test or the Picture Completion. These tests were frequently interesting in cases of less serious disturbances, however; they were sometimes carried through with a good deal of oral comment which helped in analyzing the performance.

The Knox Cube Test, where the subject must imitate the patterns made by the examiner, was also important for the aphasic patients, and was a more satisfactory imitation test than the Adaptation Board.

The Substitution Test was frequently given in the complete form constructed by Woodworth and Wells, that is, twice the length used in the Pintner Paterson Performance Scale. In the longer form, with times recorded separately for each line, it proved interesting as a learning test, and more satisfactory than the Easy or Hard Learning Tests of the Pintner Non-Language Scale.

PINTNER NON-LANGUAGE MENTAL TEST. The Pintner Non-Language Mental Test was given in full to both normal and pathological cases.[49] With the exception of that for the Easy Learning Test, the normal distributions were more satisfactory than those for most of the tests of the Pintner Paterson Performance Scale. Medians and quartiles are shown in Table XXIV.

For the aphasic patients the most interesting subtests were probably the Imitation and the Drawing Completion Tests. On the first of these the patient attempted to reproduce the twelve successive patterns made by the examiner in pointing from one to another of the four dots on the basis of which the pattern is formed. The principle of the test is very like that of the Knox Cube Test, but the correlation between the two was only $+.59 \pm .07$ for the normal group. The Drawing Completion Test was important in the study of each patient's drawing. His understanding of the incomplete pictures and his perception of the missing parts were compared to the qualities of his own drawing. His comments as he worked often led to a satisfactory analysis of the nature of his difficulty. It was not so easy to determine the nature of the difficulty on the Reversed Drawing Test, where the patient had to complete the second of a pair of figures so that it looked just like the first "only turned over"; or on the Picture Reconstruction, where he had to indicate how the disarranged parts of each picture should be put together to make a complete, coherent whole. It seems probable that picture reconstruction tests are valuable in the study of aphasia, but that they should be presented in a simpler form so that the patient can actually arrange the pictures. The remaining two tests of the battery, the Easy and Hard Learning, are digit-symbol substitution tests. The Hard Learning, the better test for the normal group, gave a correlation of +.70 ±.05 for the normal white patients with the Substitution Test of the Pintner Paterson Performance Scale.

---

[49] R. Pintner, *A Non-Language Group Intelligence Test,* J. Appl. Psychol., 1919, 3, 199–214. Test booklets published by College Book Company, Columbus, Ohio.

Drawing tests. The two tests for the *reproduction of geometrical figures* used with the normal group were the Designs of the Stanford Binet Scale, Year X, and the patterns of the Kuhlmann Test of Immediate Recall. Only 61 per cent of the normal group reproduced the Stanford Binet Designs sufficiently well for a plus score.[50] The Kuhlmann Test was more satisfactory in that degrees of ability were better estimated.[51] For the 53 patients of the normal group tested the median and quartiles for error scores were: median 9.3, upper quartile 4.5, lower quartile 10.9; for the average time: median 12.8, upper quartile 9.5, lower quartile 17.1. These tests were too difficult for many of the aphasic patients, and were therefore replaced by tests for the reproduction of simple geometrical forms.[52] If these also showed marked disturbances the same forms were later presented for the patient to copy. In addition, many patients were asked to draw simple geometrical figures at command in order to determine whether they could make these relatively easy constructions.

In cases where there were marked or interesting disturbances in drawing the aphasic patients were given several objects to draw from a model, the most complicated of which was a chair. This object was selected because it was convenient and sufficiently difficult to be a satisfactory problem for the normal adults. An attempt was made to standardize a test of *drawing a chair from a model* along lines similar to Goodenough's test of drawing a man from memory.[53] The chair was set at such an angle that the patient could see the left rear leg between the right front and rear legs. If the patient started to draw the chair as seen straight from the front, he was allowed to continue without comment. The type of chair always used was an upright chair without arms.

---

[50] Terman, *op. cit.*, 260–262.

[51] Kuhlmann, *op. cit.*, 134. Cards containing the figures are published by Warwick and York, Baltimore.

[52] The figures most used were the series of 10 designs of Ellis' Visual Memory Test (Stoelting, Chicago). For more complicated figures, the Healy Visual Design Test (Healy, Bronner, *et al.*, *op. cit.*, 86), and the series of figures from the Gates Visual Memory Tests (Gates, *op. cit.*, 400–401) were used. In addition, special figures had to be constructed for some cases; for example, to determine whether the patient tended to neglect detail on one side of the drawing more than on the other.

[53] F. L. Goodenough, *Measurement of Intelligence by Drawings* (Yonkers: World Book Co., 1926).

The following scoring system was adopted:

1a. Top line for back of chair.
 b. Upright on one side of back.
 c. Upright on the other side.
 d. Middle slat, bar or panel.
2a. Seat of chair.
 b. Attachment of seat to back.
3a. Left rear leg.
 b. Left front leg.
 c. Right front leg.
 d. Right rear leg.
 e. Correct position and angle of left rear leg.
 f. Correct position and angle of left front leg.
 g. Correct position and angle of right front leg.
 h. Correct position and angle of right rear leg.
 i. Stretchers.
 j. Correct number of stretchers.
 k. Correct position of stretchers.
4a. Proportion: back narrower than high.
 b. Proportion: back longer than front legs.
 c. Proportion: seat area less than that of back.
 d. Proportion: legs roughly equivalent in length.
5a. Lines "reasonably firm and mostly meeting."
 b. Lines firm and meeting.
6a. Perspective indicated by shape of seat.
 b. Angle of attachment of seat and back, indicating that seat and back are approximately at right angles.
 c. Legs showing no transparency, and correct super-position, i.e., of seat, legs, and stretchers.

Scored in terms of total number of these points credited, the normal performances distributed very well. The median and quartiles are shown in Table XXIV.

The *Goodenough Test of Drawing a Man* was used extensively with both normal and aphasic patients.[54] Like the drawing of a chair, it showed generally low correlations with the other tests of the battery for the patients of the normal group. The normal median and quartiles are recorded in Table XXIV. As in other types of drawing the aphasic patient's responses often showed con-

[54] *Ibid.*

siderable disparity between the quality of the drawing and the condition of the language processes.

Handedness

Tests of handedness were not practical for the pathological cases; the large majority of the patients had some weakness or loss of motor function which prevented any determination as to the dominant hand or foot. As many facts as possible were obtained from the patient or his relatives, mostly on the basis of the following questions:

Which hand do you use most?
Which hand do you use when you eat? Write? Hold scissors? Hold a needle? Use a penknife?
Which arm do you use when you throw a ball?
How do you hold a baseball bat? A golf club? A broom? A rake? A shovel or a spade? Which foot do you put on the spade?
How do you deal cards?
Do you remember being told which hand you used most as a little child?
When you went to school which hand were you taught to use?
Have you ever broken or injured either arm or hand? How long ago? How long was it before you could use that hand?

Further questions on the hand used in reaching for a doorknob or the foot used in kicking or stepping up were asked, but usually brought forth little information.

The Miles A.B.C. Vision Test was employed whenever possible to indicate the eye used in sighting.[55] The patient, without being told that this was a test for ocular dominance, raised the "V-scope" to his eyes and looked through at a card held by the examiner 10 feet away. He was unable to look at the object through the scope with both eyes, and the examiner could tell which eye he was using by the position of the scope. A number of trials were always given to make certain of the typical position.

2. SUPPLEMENTARY TESTS

Sound Recognition

When tests showed that a patient had difficulty in recognizing speech sounds or differentiating between them, an experiment was made to see whether he recognized various non-speech sounds. The following objects were assembled on a wooden table in front of the patient: a nickel, sponge, small tin box, empty box for safety matches, box part full of safety matches, large three-inch square paper clip, small paper clip, pencil, pencil eraser, heavy iron magnet three inches across, small tin snapper, comb, rubber band, small bell, and some paper 8½ by 11 inches. By verbal directions or by gesture the patient was shown that he must listen to the sound made behind the screen and when the screen was removed, attempt to reproduce it by means of one of the objects on the table. Different sounds were then produced by:

---

[55] W. R. Miles, Psychological Laboratories, Stanford University, California.

Dropping the nickel on the wooden table.
Ringing the bell.
Dropping the sponge on the table.
Dropping the empty matchbox on the table.
Running a finger along the comb.
Dropping the piece of heavy metal, the magnet, on the table.
Dropping the small paper clip on the table.
Dropping the eraser on the table.
Snapping the rubber band.
Dropping the tin box on the table.
Dropping the box part full of matches on the table.
Dropping the large paper clip on the table.
Dropping the pencil on the table.
Crackling the paper.

The difficulty with this test was that it required a fairly intelligent adjustment and could not be used in cases of severe deterioration where it would often have been most interesting. When results were questionable, demonstrations were given, with each sound reproduced for the patient to see, and the series was then given again in reverse order.

Gates Tests of Visual Perception and Selection

In cases where there seemed to be difficulty in the perception of letter-forms, the Gates Tests of Visual Perception and Selection were always given.[56] They proved valuable in showing the relative difficulty in perceiving slight differences in figures, number series, and letter series. The procedure used was that described by the author, but the tests were frequently continued for more than the usual time so that enough material would be available to analyze the types of error.

Tests of Canceling Letters

Tests of canceling letters in a page of pied text were also employed to study difficulties in the perception of letter-forms. That most frequently used was the sheet for canceling "a's" (Test No. 27008, Stoelting, Chicago). Scored in terms of number of "a's" crossed in 1½ minutes, the findings for the 55 adults of the normal group were: median 19.6, upper quartile 23.6, lower quartile 14.2.

---

[56] Gates, *op. cit.*, 388–398.

Chapman Cook Speed of Reading Test

When patients read fairly well but seemed to be unusually slow in reading, the Chapman Cook Speed of Reading Test was given.[57]

Woody Arithmetic Scales

Analysis of the results on the Stanford Achievement Computation Test usually showed whether the patient had particular difficulty with one or more of the four fundamental processes, but when further data on the subject were necessary the Woody Arithmetic Scales with separate tests in addition, subtraction, multiplication, and division were used.[58]

Special Number Study

In some cases of marked or particularly interesting disturbances in arithmetic, a special number study was made on the basis of part or all of the material outlined below.[59]

Number Study

1. *Orientation*
   What date is today? Day of week? Month? Day of month? Year?
   What time is it? Guesses. Looks for watch.
   What time do you have dinner?
   How old are you?
   How long ago was your attack? (Accident.)
   How long have you been in the hospital?

2. *Understanding of "number" words*
   How many minutes are there in an hour?
   How many hours are there in a day?
   How many days are there in a month?
   How many days are there in a week?
   How many weeks are there in a year?
   How many days are there in a year?
   How many months are there in a year?
   How many are there in a dozen?
   How many are there in a pair?
   How many cents are there in a dollar?
   How many dimes are there in a dollar?

---

[57] Published by J. B. Lippincott Co., Philadelphia.

[58] Published by the Bureau of Publications, Teachers College, Columbia University.

[59] This study is patterned to some extent after that described by Goldstein, *Die Behandlung, Fürsorge und Begutachtung der Hirnverletzten,* 1919, 126–134.

How many nickels are there in a dollar?
How many nickels are there in a quarter?

In these questions does he answer verbally?
Does he indicate? How?

3. *Reading and writing of numbers*
Reads: 7 2 8 16 23 9 57 104 572 699 1001 2805 75093 III V IV VII XIII XIX — + × ÷ =
Writes the above, or reversed, to dictation.
Copies the above from printed cards.
Recognizes wooden numbers placed in hand.
Recognizes numbers traced on hand.
Picks out $\left\{\begin{array}{l}\text{printed}\\ \text{wooden}\end{array}\right.$ numbers at command.

4. *Counting*
Counts forwards: How far? Time
Writes number series forwards: Time
Arranges wooden or printed numbers in series: Time
Recognizes errors in series wrongly arranged
Counts backwards from 20 to 1:[60] Time Errors
Counts forwards, starting at 10: Does he start spontaneously?
Counts forwards, starting at 23: Does he start spontaneously?
Counts by twos:
Counts by fives:
Counts by tens:
Counts pennies:[61] Four Thirteen
Counts dots:[62] Time Errors
Counts taps:[63]

5. *Series meaning*
What number comes after 4?
After 3?
Before 13?
After 24?
After 69?
After 6?
After 8?
Before 6?
Before 38?
Before 100?
Before 10?
After 11?
Before 15?
Before 53?
After 200?
More successful when these are presented orally? In print?

6. *Collectional meaning*
From a group of toothpicks, selects: 5 3 4 8 10 7
At oral command
At printed command

---

[60] Terman, *op. cit.*, 213–215.

[61] *Ibid.*, 154–155; 180–181.

[62] Kuhlmann, *op. cit.*, 117–118.

[63] *Ibid.*, 106–107; 124–125.

When separate groups are made of 4 2 3 7 9 6 toothpicks, names number in each

Indicates numbers at $\left\{\begin{array}{l}\text{oral}\\ \text{printed}\end{array}\right.$ command

Can he make 1st group equal to 4th? (Add 3.)
2nd group equal to 5th? (Add 7.)
3rd group equal to 6th? (Add 3.)

Can he match groups with others of like numbers?

7. *Relational meaning*

Which is greater? (Or bigger? See that he knows meaning of word by asking about sizes of convenient objects.)

Responds to oral question:		Responds to printed question:
	6 or 5	
	3 or 8	
	10 or 11	
	17 or 7	
	2 or 4	
	23 or 32	
	9 or 6	
	101 or 110	
	1000 or 100	
	5 or 50	

8. *Money*

Names nickel[64] penny quarter dime

Shows equivalent value for nickel, quarter, and dime separately by selecting coins from a pile containing: 13 pennies, 2 nickels, 2 dimes, and 2 quarters. Has he any difficulty in handling money now?

Give examples:

9. *Oral arithmetic*

Express first as "plus," "minus," "multiply," and "divide." If necessary, repeat using simpler terms, "and," "take away," "times," and "into."

If patient still cannot answer, give him choice of three consecutive numbers, varying the position of the correct answer so that it will be sometimes first, sometimes middle, and sometimes last. Record numbers offered and choice.

1. $1 + 1$	2. $5 - 4$	3. 1×5	4. $8 - 7$
5. $5 + 0$	6. $4 \div 2$	7. $8 + 7$	8. $3 - 0$
9. 7×7	10. $21 \div 3$	11. $3 \div 1$	12. 8×6
13. $3 + 8$	14. $11 - 8$	15. 0×8	16. $24 \div 8$
17. 9×0	18. $7 \div 7$	19. $5 + 9$	20. $16 - 7$

---

[64] Terman, *op. cit.*, 184–185.

Jaederholm Classification Test

Classification tests such as the Jaederholm were interesting from two points of view: first, as an index of the richness of vocabulary and, second, as an index of the patient's concept of a class of objects. On the Jaederholm Test the subject is asked to name as many as possible items in each of the following classes in one minute apiece: 1) animals, 2) flowers, 3) objects made of wood, and 4) objects made of iron. If the aphasic patient's responses were interesting, the time limit was often extended. All the patients did relatively better in naming animals than in naming members of any other class.

Word-Building Test

Word-building tests were used both in studying word-formation and in studying the richness of vocabulary. The letters most frequently given were A E I R L P and A E O B M T.[65] If the patient did not do well, he was given the series in block letters so that he could make the actual letter arrangements. When he thought he had made a word, he copied it down and began another.

Sentence Construction Test

For patients who had difficulty in sentence construction a special test was devised, consisting of the following words, each of which was printed on a separate card: and, are, been, cities, do, go, have, his, in, is, men, the, to, where, work. These were arranged in a row in alphabetical order, and the patient was told to select some of them which could be laid together to make a good sentence. If he were unable to do so, the sample sentence, "Men have to work," was laid out for him. His attempts were timed and recorded as each change was made in order to study the processes of sentence construction in this test situation.

Pictures of the Stanford Binet Scale

The Stanford Binet Pictures often afforded a very interesting test.[66] In describing or interpreting them, the patient clearly showed his particular expressive difficulties as well as the nature of his reaction to fairly complex pictorial situations.

The Porteus Maze Test

The Porteus Maze Test was used with the pathological cases chiefly because of interest in the test.[67] Year V and sometimes Year VI were used as demonstration mazes. The times required for each maze were recorded. The median and quartiles for the 58 patients of the normal group were: median 180, upper quartile 200, lower quartile 159. As on other non-language tests, some aphasic patients gave remarkably good performances. The majority, however, seemed to show more or less deterioration. The difficulty rarely if ever seemed to depend on lack of "foresight." The typical patient worked slowly and paused at all crucial points in the maze. He was usually, however, unable to make a satisfactory "visual analysis" of the more complicated mazes.

---

[65] Healy, Bronner, *et al.*, *op. cit.*, 63; 191.

[66] Terman, *op. cit.*, 145–146; 190–193; 302–306.

[67] S. D. Porteus, *Guide to the Porteus Maze Test* (Vineland, New Jersey: Publications of the Training School, 1924).

Stenquist Mechanical Aptitudes Test

When patients seemed particularly able in some non-language activities, a further check was made by asking them to assemble the ten different contrivances of the Stenquist Mechanical Aptitudes Test, Series I.[68] Descriptive records of the patient's behavior and time records were made as exactly as possible. Scores were compared with the norms established for army men during the War.

3. SHORTER BATTERIES

A Short Battery of Tests for Use in Cases of Severe Disorders; Probable Time, 2 to 3 Hours

Records of spontaneous and reactive speech (page 567).

Automatic Word Series (pages 567–568).

Head's Object-Naming Test (pages 568–569).

Repetition of Familiar Phrases and Sentences (page 570).

Gates Word, Phrase, and Sentence Reading Test, given orally, or Following of Directions Test (pages 571 and 572).

Gates Word Pronunciation Test or Gray Oral Reading Paragraphs, Set I or II (pages 573 and 574).

Records of spontaneous writing (page 578).

Morrison McCall Word Dictation Test or Gates Oral Spelling Test (pages 578 and 579).

Stanford Achievement Arithmetic Computation Test (page 580).

Oral or Printed Opposites Tests (pages 581–582).

Stanford Binet Vocabulary Test (page 589).

Seguin, Two-Figure, and Casuist Formboards (page 591).

Knox Cube Test (page 591).

Picture Completion or Drawing Completion Tests (pages 591–592).

Reproduction of simple figures (page 592).

Drawing a chair or a man (pages 592 and 593).

---

[68] J. L. Stenquist, *Measurements of Mechanical Ability* (New York: Teachers College Contributions to Education, No. 130, 1923).

A Short Battery of Tests for Use in Cases of Slighter Disorders; Probable Time, 2 to 3 Hours

Records of spontaneous speech (page 567).

Naming the series of Kuhlmann Line Drawings (pages 568–569).

Following of Directions Test or Head's Hand, Ear, and Eye Test (pages 572 and 573).

Gray Oral Reading Paragraphs, Sets II and III or III and IV (page 574).

Chapman Unspeeded Reading-Comprehension Test (page 576).

Stanford Achievement Dictation Test (page 579).

Stanford Achievement Arithmetic Computation Test (page 580).

Oral or Printed Analogies Tests (pages 583–586).

Sentence Completion Test (pages 586–587).

Oral or Printed Absurdities Tests (pages 587–588).

Imitation Test of the Pintner Non-Language Scale (page 591).

Drawing Completion Test of the Pintner Non-Language Scale (pages 591–592).

Drawing of a Man, Goodenough Scale (pages 593–594).

BIBLIOGRAPHY

ANGYAL, L. VON. Ueber den subkortikalen Anteil der schizophrenen Sprachstörungen. Msch. f. Psychiat. u. Neur., 1933, 86, 137–165.

ARNDT. Fall von isolierter Apraxie der Gesichtsmuskulatur. Zbl. f. d. ges. Neur. u. Psychiat., 1928, 50, 324–325.

ASHBY, W. R. The "Path" Theory of Cortical Function. J. Neur. & Psychopath., 1931, 12, 148–157.

BABCOCK, H. An Experiment in the Measurement of Mental Deterioration. Arch. Psychol., 1930, 18, No. 117. 105 pp.

BAILEY, P. A Contribution to the Study of Aphasia and Apraxia. Arch. Neur. & Psychiat., 1924, 11, 501–529.

BALLET, G. Un cas d'aphasie motrice pure chez un paralytique général. Rev. neur., 1900, 8, 346–347.

BARANY, R. Kortikaler Mechanismus der Sprache. J. f. Psychol. u. Neur., 1930, 40, 282–297.

BARD, L. Un cas d'alexie d'origine opératoire. Sem. méd., 1902, 22, 145–147.

BARENNE, J. G. D. DE. "Corticalization" of Function and Functional Localization in the Cerebral Cortex. Arch. Neur. & Psychiat., 1933, 30, 884–901.

BARRETT, A. M. A Case of Pure Word-Deafness with Autopsy. J. Nerv. & Ment. Dis., 1910, 37, 73–92.

BARUK, H., and DEREUX, J. Syndrome occipital avec hallucinose et amnésie verbale visuelle. Bull. et mém. Soc. méd. d. hôp. de Paris, 1926, 50, 1463–1467.

BARUK, H., and HARTMANN, E. Un cas d'alexie pure avec agnosie visuelle. Encéphale, 1927, 22, 796–801.

BASTIAN, H. D. Aphasia and other Speech Defects. London: H. K. Lewis, 1898. viii + 366 pp.

BENARY, W. Zur Frage der Methoden psychologischer Intelligenz- und Eignungsprüfungen. Zsch. f. angew. Psychol., 1920, 17, 110–133.

BENARY, W. Psychologische Analysen hirnpathologischer Fälle. VIII. Studien zur Untersuchung der Intelligenz bei einem Fall von Seelenblindheit. Psychol. Forsch., 1922, 2, 209–297.

BENEDEK, L., and SCHILDER, P. Ueber das Nachsprechen von Testworten bei einer in Rückbildung begriffenen motorischen Aphasie. Allg. Zsch. f. Psychiat., 1924, 81, 79–86.

BERGER, H. Ueber Rechenstörungen bei Herderkrankungen des Grosshirns. Arch. f. Psychiat. u. Nervenkh., 1926, 78, 238–263.

BERINGER, K., and STEIN, J. Analyse eines Falles von "Reiner" Alexie. Zsch. f. d. ges. Neur. u. Psychiat., 1930, 123, 472–478.

Bianchi, L. Su una 'varieta' insolita di afasia. Riforma med., 1926, 42, 625–626.

Binet, A., and Simon, Th. Langage et pensée. Année psychol., 1908, 14, 284–339.

Binswanger, L. Zum Problem von Sprache und Denken. Schweiz. Arch. f. Neur. u. Psychiat., 1926, 18, 247–283.

Boinet, M. Aphasie (de cause traumatique). Bull. de la Soc. de chir. de Paris, 1871, 12, 42–46.

Bonhoeffer, K. Zur Klinik und Lokalisation des Agrammatismus und der Rechts-Links-Desorientierung. Msch. f. Psychiat. u. Neur., 1923, 54, 11–42.

Bonvicini, G. Ueber subkorticale sensorische Aphasie. Jahrb. f. Psychiat. u. Neur., 1905, 26, 126–229.

Bonvicini, G. Ueber bilaterale Apraxie des Gesichts- und Sprechmuskulatur. Jahrb. f. Psychiat. u. Neur., 1914, 36, 563–630.

Bonvicini, G. Von Broca zu Head. Wien. med. Woch., 1928, 78, 2, 897–898; 993–995.

Bonvicini, G. Die Störungen der Lautsprache bei Temporallappenläsionen. Handb. d. Neur. d. Ohres, 1929, 2, Teil 2, 1571–1868. Vienna and Berlin: Urban & Schwarzenberg, 1929.

Borel, M. G. Cécité verbale traumatique pure. Bull. et mém. Soc. franç. d'opth., 1932, 45, 417–437.

Borel, M. G. Alexie traumatique pure. Ann. d'ocul., 1932, 169, 837–838.

Bostroem. Psychische Erscheinungen bei Hirntumoren und ihre Bedeutung für Diagnose und Lokaldiagnose. Arch. f. Psychiat. u. Nervenkh., 1929, 88, 805–806.

Bouman, L. Cécité verbale pure. Psychiat. en neur. bl., 1928, 32, 328–339.

Bouman, L., and Grünbaum, A. A. Experimentell-psychologische Untersuchungen zur Aphasie und Paraphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1925, 96, 481–538.

Bouman, L., and Grünbaum, A. A. Ueber motorische Momente der Agraphie. Msch. f. Psychiat. u. Neur., 1930, 77, 223–260.

Brandt, A. Ueber isolierte Agraphie und Alexie. Dtsch. Zsch. f. Nervenhk., 1928, 104, 209–221.

Brissaud, E. Cécité verbale sans aphasie ni agraphie. Rev. neur., 1900, 8, 757.

Brunner, H., and Stengel, E. Zur Lehre von den Aphasien im Kindesalter. Zsch. f. d. ges. Neur. u. Psychiat., 1932, 142, 430–450.

Bürger, H. Zur Psychologie des amnestischen Symptomkomplexes. Arch. f. Psychiat. u. Nervenkh., 1927, 81, 348–352.

Casamajor, L. The Evolution of Symbols in the Development of Consciousness. Arch. Neur. & Psychiat., 1929, 22, 865–872.

CASSIRER, E. Le langage et le monde des objets. J. de psychol., 1933, 30, 18–44.

CHARCOT, J. M. Des variétés de l'aphasie. Progrès méd., 1883, 11, 441–444; 469–471; 487–488; 521–523.

CONRAD, K. Versuch einer psychologischen Analyse des Parietalsyndroms. Msch. f. Psychiat. u. Neur., 1932, 84, 28–97.

CRINIS, M. DE. Aufbau und Abbau der Grosshirnleistungen und ihre anatomischen Grundlagen. Berlin: S. Karger, 1934. 95 pp.

CROUZON, O., and FOULON. Un cas d'aphasie semblant due au premier abord à une atteinte du pied de la 3^e circonvolution frontale gauche, mais avec lésion profonde dans la zone quadrilatère de Pierre Marie. Bull. et mém. Soc. méd. d. hôp. de Paris, 1927, 51, 506–508.

DAHMANN, H. Zur Frage der amnestischen, insbesondere der sogenannten optischen Aphasie. Folia oto-laryng., 1930, 20, 188–201.

DANDY, W. E. The Effects of Total Removal of the Left Temporal Lobe in a Right Handed Individual: Localization of Areas of the Brain concerned with Speech. J. Nerv. & Ment. Dis., 1931, 74, 739–742.

DAVIES, A. E. Speech Reactions and the Phenomena of Aphasia. Psychol. Rev., 1926, 33, 411–450.

DECROLY, O. Un cas d'alexie et d'agraphie congénitale chez un débile mental. J. de neur. et de psychiat., 1929, 29, 346–362.

DEDIĆ, ST. Zur Aphasiefrage. Zsch. f. d. ges. Neur. u. Psychiat., 1926, 106, 208–213.

DEJERINE, J. Étude sur l'aphasie. Rev. de méd., 1885, 5, 174–191.

DEJERINE, J., and PÉLISSIER, A. Contribution à l'étude de la cécité verbale pure. Encéphale, 1914–19, 9–14, 1–29.

DELACROIX, H. Le langage et la pensée. Paris: Félix Alcan, 1924. 602 pp.

DELACROIX, H. L'analyse psychologique de la fonction linguistique. Oxford: Clarendon Press, 1926. 28 pp.

DELACROIX, H. L'aphasie selon H. Head. J. de psychol., 1927, 24, 285–322.

DERCUM, F. X. The Clinical Interpretation of Aphasia. N. Y. Med. J., 1914, 99, 865–870.

DIDE, M., and BOTCAZO. Amnésie continue, cécité verbale pure, perte du sens topographique, ramollissement double du lobe lingual. Rev. neur., 1902, 10, 676–680.

DIMITRI, V. Afasia por hemorragia de la zona lenticular. (Observación anátomo-clinica.) Rev. Asoc. méd. argent., 1933, 47, 1998–2002.

DIMITRI, V. Contribución anátomo-clinica al estudio de las afasias. Rev. Asoc. méd. argent., 1933, 47, 2002–2018.

DUFOUR, H., and NATIVELLE, M. Aphasie motrice pure ou dysarthrie sans autres troubles du langage. Bull. et mém. Soc. méd. d. hôp. de Paris, 1927, 51, 740–742.

Dürk, J. Die experimentelle Psychologie im Dienste der Wieder-Ertüchtigung Gehirnverletzer. Zsch. f. angew. Psychol., 1918, 13, 140–146.

Ehrenwald, H. Ueber das "Lesen" mit Umgehung des optischen Wahrnehmungsapparates. Zsch. f. d. ges. Neur. u. Psychiat., 1930, 123, 204–223.

Ehrenwald, H. Störung der Zeitauffassung, der räumlichen Orientierung, des Zeichnens und des Rechnens bei einem Hirnverletzten. Zsch. f. d. ges. Neur. u. Psychiat., 1931, 132, 518–569.

Elder, W. The Clinical Varieties of Visual Aphasia. Edinb. Med. J., 1900, 49, 433–454.

Engerth, G. Zeichnensstörungen bei Patienten mit Autotopagnosie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 143, 381–402.

Engerth, G., and Urban, H. Zur Kenntnis der gestörten künstlerischen Leistung bei sensorischer Aphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 145, 753–787.

Ewing, A. W. G. Aphasia in Children. New York: Oxford University Press, 1930. 152 pp.

Fabritius, H. Ein Fall von sensorischer Aphasie mit Störungen der Zungensensibilität (Tastkreise). Msch. f. Psychiat. u. Neur., 1928, 68, 192–200.

Feist, G. H., and Sittig, O. Zur Frage der reinen Wortstummheit. Med. Klin., 1929, 25, 1, 942–944.

Fernberger, S. W. Possible Effects of Imaginal Type of the Subject on Aphasic Disturbances. Amer. J. Psychol., 1919, 30, 327–336.

Feuchtwanger, E. Amusie. Studien zur pathologischen Psychologie der akustischen Wahrnehmung und Vorstellung und ihrer Strukturgebiete, besonders in Musik und Sprache. Berlin: Julius Springer, 1930. v + 295 pp.

Fischer, S. Ueber das Entstehen und Vorstehen von Namen, mit einem Beitrage zur Lehre von den transkortikalen Aphasien. Arch. f. d. ges. Psychol., 1922, 42, 335–368; 43, 32–63.

Flesch, J. Verbale Alexie mit Hemiachromatopsie. Wien. med. Woch., 1908, 58, 2367–2370.

Foerster, O., and Goldstein, K. Restitution. Trans. of German Neur. Soc., 20th Annual Congress, Sept. 18–20, 1930. Abstracted by W. J. Bernis, Arch. Neur. & Psychiat., 1932, 27, 725–752.

Foix, C. Sur l'anatomie pathologique de l'aphasie. Ann. d'anat. path. méd.-chir., 1926, 3, 787–814.

Foix, C. Aphasies. Nouveau traité de médecine, 18, 135–213. Paris: Masson et Cie., 1928.

Foix, C., and Levy, M. Diagnostic des Aphasies. Monde méd., 1926, 36, 931–943.

Fox, C. Tests of Aphasia. Brit. J. Psychol., Gen. Sec., 1931, 21, 242–255.

Franz, S. I. On Certain Fluctuations in Cerebral Function in Aphasics. J. Exper. Psychol., 1916, 1, 355–364.

Franz, S. I. Handbook of Mental Examination Methods. 2d ed. New York: Macmillan, 1919. 193 pp.

Franz, S. I. Studies in Re-education: the Aphasias. J. Comp. Psychol., 1924, 4, 349–429.

Franz, S. I. The Relations of Aphasia. J. Gen. Psychol., 1930, 3, 401–411.

Frazier, C. H., and Ingham, S. D. A Review of the Effects of Gunshot Wounds of the Head. Arch. Neur. & Psychiat., 1920, 3, 17–40.

Fremel, F. Schläfenlappen Abszess mit Aphasie. Msch. f. Ohrenhk., 1932, 66, 101–103.

Friedemann, A., and Krauss, S. Aphasische Syndrome bei toxisch-infektiös-traumatischen Erkrankungen. Dtsch. Zsch. f. Nervenhk., 1929, 111, 222–225.

Froment, J. Comment étudier les troubles du langage? Rev. neur., 1924, 2, 375–382.

Fröschels, E. Ueber Aphasien im Kindesalter und über die logopädische Therapie von Aphasien. Med. Klin., 1928, 24, 1, 446–447.

Fröschels, E. Erkenntnistheoretische Zuordnung und Begründung der alten und der neuen Aphasietheorien. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 143, 589–604.

Fröschels, E. Ueber neuere Vorstellungen vom Wesen der Aphasien und die kategoriale Bedeutung der Aphasietheorien. Wien. klin. Woch., 1928, 41, 1, 669–671.

Gehuchten, P. van. Tumeur frontale gauche avec aphasie amnésique. Contribution à l'étude de l'aphasie motrice. Rev. belge sc. méd., 1931, 3, 831–840.

Gehuchten, P. van. Contribution à l'étude de l'aphasie motrice. Bull. Acad. roy. de méd. de Belgique, 1932, 12, 525–526.

Gelb, A. Remarques générales sur l'utilisation des données pathologiques pour la psychologie et la philosophie du langage. J. de psychol., 1933, 30, 403–429.

Gelb, A., and Goldstein, K. Psychologische Analysen hirnpathologischer Fälle. X. Ueber Farbennamenamnesie. Psychol. Forsch., 1924, 6, 127–186.

Gelb, A., Goldstein, K., and Mäki, N. Psychologische Analysen hirnpathologischer Fälle. XII. Natürliche Bewegungstendenzen der rechten und der linken Hand und ihr Einfluss auf das Zeichnen und den Erkennungsvorgang. Psychol. Forsch., 1928, 10, 1–19.

German, W. J. Aphasia. Yale J. Biol. and Med., 1929, 1, 363–383.

Gerstmann, J. Fingeragnosie. Eine umschriebene Störung der Orientierung am eigenen Körper. Wien. klin. Woch., 1924, 37, 1010–1012.

Gerstmann, J. Fingeragnosie und isolierte Agraphie—ein neues Syndrom. Zsch. f. d. ges. Neur. u. Psychiat., 1927, 108, 152–177.

Gerstmann, J. Zur lokaldiagnostischen Verwertbarheit des Syndroms: Fingeragnosie, Rechts-Links-Störung, Agraphie, Akalkulie. Jahrb. f. Psychiat. u. Neur., 1932, 48, 135–143.

Goldstein, K. Uebungsschulen für Hirnverletzte. Zsch. f. Kruppelfürsorge, 1916, 9, 17–21.

Goldstein, K. Die Behandlung, Fürsorge und Begutachtung der Hirnverletzten. Leipzig: F. C. W. Vogel, 1919. 240 pp.

Goldstein, K. Ueber den Einfluss von Sprachstörungen auf das Verhalten gegenüber Farben. Dtsch. Zsch. f. Nervenhk., 1922, 74, 260–262.

Goldstein, K. Ueber die Abhängigkeit der Bewegungen von optischen Vorgänger, Bewegungsstörungen bei Seelenblinden. Msch. f. Psychiat. u. Neur., 1923, 54, 141–194.

Goldstein, K. Die Topik der Hirnrinde in ihrer Bedeutung für die Klinik. Psychiat.-Neur. Woch., 1924, 26, 43–46; 55–60.

Goldstein, K. Das Wesen der amnestischen Aphasie. Schweiz. Arch. f. Neur. u. Psychiat., 1924, 15, 163–175.

Goldstein, K. Zur Theorie der Funktion des Nervensystems. Arch. f. Psychiat. u. Nervenkh., 1925, 74, 370–405.

Goldstein, K. Ueber Aphasie. Schweiz. Arch. f. Neur. u. Psychiat., 1926, 19, 3–38.

Goldstein, K. Die Lokalisation in der Grosshirnrinde. Handb. d. norm. u. path. Physiol., 10, 600–842. Berlin: Julius Springer, 1927.

Goldstein, K. Beobachtungen über die Veränderungen des Gesamtverhaltens bei Gehirnschädigung. Msch. f. Psychiat. u. Neur., 1928, 68, 217–242.

Goldstein, K. Die zwei Formen der Störungsmöglichkeit der Sprache durch Hirnschädigung. Arch. f. Psychiat. u. Nervenkh., 1931, 95, 730–743.

Goldstein, K. L'analyse de l'aphasie et l'étude de l'essence du langage. J. de psychol., 1933, 30, 430–496.

Goldstein, K. Der autoptische Befund in einem Fall von Störungen verschiedenster Leistungsgebiete bei Herderkrankung. Schweiz. Arch. f. Neur. u. Psychiat., 1934, 33, 242–249.

Goldstein, K., and Gelb, A. Psychologische Analysen hirnpathologischer Fälle. I. Zur Psychologie des optischen Wahrnehmungs- und Erkennungsvorganges. Zsch. f. d. ges. Neur. u. Psychiat., 1918, 41, 1–142.

Göpfert, H. Beiträge zur Frage der Restitution nach Hirnverletzung. Zsch. f. d. ges. Neur. u. Psychiat., 1922, 75, 411–459.

Gordon, H. Hand and Ear Tests. Brit. J. Psychol., Gen. Sec., 1922–23, 13, 283–300.

Gordon, R. G., and Norman, R. M. Some Psychological Experiments on Men-

tal Defectives in Relation to the Perceptual Configurations which may underlie Speech. Brit. J. Psychol., Gen. Sec., 1932, 23, 20–41; 85–113.

Grashey. Ueber Aphasie und ihre Beziehungen zur Wahrnehmung. Arch. f. Psychiat. u. Nervenkh., 1885, 16, 654–688.

Grubel, R. Ein Beitrag zur Frage der Leitungsaphasie. Arch. f. Psychiat. u. Nervenkh., 1926, 76, 410–430.

Grünbaum, A. A. Ueber Apraxie. Zbl. f. d. ges. Neur. u. Psychiat., 1930, 55, 788–792.

Grünbaum, A. A. Aphasie und Motorik. Zsch. f. d. ges. Neur. u. Psychiat., 1930, 130, 385–412.

Grünbaum, A. A. Wahrnehmung und Motorik bei der Agnosie. Arch. f. Psychiat. u. Nervenkh., 1931, 95, 725–730.

Grünthal, E. Ueber Aehnlichkeiten zwischen organischer und schizophrener Denkstörung. Zsch. f. d. ges. Neur. u. Psychiat., 1931, 135, 618–626.

Halben, R. Ein Fall geheilter Wortblindheit mit Persistenz rechtseitiger Hemianopsie. Zsch. f. Augenhk., 1903, 10, 406–421; 487–499.

Hanse, A. Spiegelschrift, Linkhändigkeit und Alexie. Arch. f. Psychiat. u. Nervenkh., 1931, 93, 34–45.

Hartmann, F. Uebungsschulen für "Gehirnkrüppel" (Sprachkranke und andere Gehirnverletzte). Münch. med. Woch., 1915, 62, 1, 769–770.

Hauptmann, A. Ist die amnestische Aphasie Teilerscheinungen einer Beeinträchtigung des "kategorialen" Verhaltens? Msch. f. Psychiat. u. Neur., 1931, 79, 302–313.

Head, H. Hughlings Jackson on Aphasia and Kindred Affections of Speech. Brain, 1915, 38, 1–27.

Head, H. Aphasia: An Historical Review (The Hughlings Jackson Lecture for 1920). Proc. Roy. Soc. Med., Sec. of Neur., 1920–21, 14, 1–22; Discussion, 29–38.

Head, H. Discussion on Aphasia. Brain, 1920, 43, 412–450.

Head, H. Aphasia and Kindred Disorders of Speech. New York: Macmillan, 1926. 2 vols., xvi + 550 pp. and xxxiv + 430 pp.

Hegler, C. Zur Aphasie bei Polyglotten. Dtsch. Zsch. f. Nervenhk., 1931, 117–119; 236–239.

Heidenhain, A. Beitrag zur Kenntnis der Seelenblindheit. Msch. f. Psychiat. u. Neur., 1927, 66, 61–116.

Heilbronner, K. Die aphasischen, apraktischen und agnostischen Störungen. Handb. d. Neur., 1, Teil 2, 982–1093. Berlin: Julius Springer, 1910.

Heiligtag, F. Ein Fall von traumatischer Alexie. Dtsch. Med. Woch., 1910, 36, 2147–2148.

Henneberg, R. Ueber unvollständige reine Worttaubheit. Msch. f. Psychiat. u. Neur., 1906, 19, 17–38; 159–179.

Henneberg, R. Reine Worttaubheit. Neur. Zbl., 1918, 37, 426–427.

Henschen, S. E. Ueber die Hörsphäre. J. f. Psychol. u. Neur., 1917, 22, 319–474.

Henschen, S. E. Klinische und anatomische Beiträge zur Pathologie des Gehirns, 5–7. Stockholm: Nordiska Bokhandeln, 1920–22. 765 pp.

Henschen, S. E. Clinical and Anatomical Contributions on Brain Pathology. Abstracts and comments by W. F. Schaller. Arch. Neur. & Psychiat., 1925, 13, 226–249.

Henschen, S. E. On the Function of the Right Hemisphere of the Brain in relation to the Left in Speech, Music and Calculation. Brain, 1926, 49, 110–123.

Henschen, S. E. Aphasiesysteme. Msch. f. Psychiat. u. Neur., 1927, 65, 87–137.

Henschen, S. E. Zur Entwicklung der Aphasielehre. Msch. f. Ohrenhk. u. Laryng.-Rhinol., 1928, 62, 823–835.

Herrmann, G. Beiträge zur Lehre von den Störungen des Rechnens bei Herderkrankungen des Okzipitallappens (Akalkulie Henschen). Msch. f. Psychiat. u. Neur., 1928, 70, 193–278.

Herrmann, G., and Pötzl, O. Ueber die Agraphie und ihre Lokaldiagnostischen Beziehungen. Berlin: S. Karger, 1926. 380 pp.

Hillebrecht, K. Zur Untersuchung der zerebralen Sprachstörungen. Allg. Zsch. f. Psychiat., 1931–32, 96, 67–81.

Hilpert, P. Die Bedeutung des linken Parietallappens für das Sprechen. J. f. Psychol. u. Neur., 1930, 40, 225–255.

Hilpert, P. Aphatische Störungen bei Prozessen im Bereich des linken Gyrus supramarginalis. Arch. f. Psychiat. u. Nervenkh., 1931, 95, 743–747.

Hines, M. On Cerebral Localization. Physiol. Rev., 1929, 9, 462–574.

Hinshelwood, J. Word-Blindness and Visual Memory. Lancet, 1895, 2, 1564–1570.

Hinshelwood, J., MacPhail, A., and Ferguson, A. R. A Case of Word-Blindness, with Right Homonymous Hemianopsia. Brit. Med. J., 1904, 2, 1304–1307.

Hochheimer, W. Psychologische Analysen hirnpathologischer Fälle. XIII. Analyse eines "Seelenblinden" von der Sprache aus. Psychol. Forsch., 1932, 16, 1–69.

Hoff, H. Das Stirnhirn und seine Beziehung zu Gang und Sprache. Wien. klin. Woch., 1931, 44, 2, 1588–1593.

Hoff, H., and Hoffman, T. Ein Beitrag zur Stirnhirnfunktion und ihrer Beziehung zur Sprache und Gang. Zsch. f. d. ges. Neur. u. Psychiat., 1930, 126, 253–261.

Hoff, H., and Pötzl, O. Ueber die Aphasie eines zweisprachigen Linkshänders. Wien. med. Woch., 1932, 82, 369–373.

Howe, H. S. Cortical Word Blindness. Neur. Bull., 1921, 3, 64–71.

Hunter, W. S. A Consideration of Lashley's Theory of Equipotentiality of Cerebral Action. J. Gen. Psychol., 1930, 3, 455–468.

Idelsohn, H. Ueber einen Fall von isolirter motorischer Aphasie ohne Agraphie (subcorticale motorische Aphasie?). Dtsch. Zsch. f. Nervenhk., 1898, 12, 324–332.

Isakower, O., and **Schilder**, P. Optisch-räumliche Agnosie und Agraphie. Zsch. f. d. ges. Neur. u. Psychiat., 1928, 113, 102–142.

Isserlin, M. Demonstrationen Hirnverletzter (Agrammatismus, subcorticale Aphasie und Leitungsaphasie, optische Agnosie). Zsch. f. d. ges. Neur. u. Psychiat., Ref., 1920, 21, 357–363.

Isserlin, M. Ueber Agrammatismus. Zsch. f. d. ges. Neur. u. Psychiat., 1922, 75, 332–410.

Isserlin, M. Ueber Störungen des Gedächtnisses bei Hirngeschädigten. Zsch. f. d. ges. Neur. u. Psychiat., 1923, 85, 84–97.

Isserlin, M. Die pathologische Physiologie der Sprache. Ergeb. d. Physiol., 1929, 29, 129–249; 1931, 33, 1–102.

Isserlin, M. Ueber Sprache und Sprechen. Nervenarzt, 1932, 5, 1–7.

Isserlin, M., **Kuenburg**, M. von, and **Hofbauer**. Zur Pathologie der Beziehungen zwischen Sprechen und Denken. Zbl. f. d. ges. Neur. u. Psychiat., 1927, 47, 252–254.

Jackson, J. H. Reprint of some of Hughlings Jackson's Papers on Affections of Speech. Brain, 1915, 38, 28–190.

Jackson, J. H. Selected Writings of. Edited by James Taylor. 2, 3–237. London: Hodder & Stoughton, 1932.

Jakob, A. Die Lokalisation im Grosshirn im Lichte neuerer Tatsachen und Betrachtungsweisen. Klin. Woch., 1931, 10, 2, 2025–2030.

Janota, M. O., and **Springlova**, M. Alexie et acalculie. Rev. neur., 1930, 2, 429–431.

Jarkowski, J. Un cas d'aphasie motrice. Rev. neur., 1926, 2, 612–617.

Jellinek, A. Zur Phänomenologie der Amusie. Jahrb. f. Psychiat. u. Neur., 1933, 50, 115–141.

John, K. Zur Beurteilung psychischer Krankheitserscheinungen bei rechtsseitiger Schläfenlappenaffektion. Zsch. f. d. ges. Neur. u. Psychiat., 1930, 127, 596–614.

Jossmann, P. Zur Psychopathologie der optisch-agnostischen Störungen. Msch. f. Psychiat. u. Neur., 1929, 72, 81–149.

Jossmann, P. La valeur localisatrice des troubles dyslectiques dans le diagnostic des tumeurs cérébrales. Rev. neur., 1931, 2, 393–394.

Kauders, O. Ueber polyglotte Reaktionen bei einer sensorische Aphasien. Zsch. f. d. ges. Neur. u. Psychiat., 1929, 122, 651–666.

Kelley, T. L. Crossroads in the Mind of Man. Stanford University: Stanford University Press, 1928. vii + 238 pp.

Ketterer, K., and Zwirner, E. Psychologisch-phonetischer Beitrag zum Problem der Aphasie: 1. Mitteilung. J. f. Psychol. u. Neur., 1932, 44, 690–738.

Klein, R. Ueber reine Worttaubheit mit besonderer Berücksichtigung der Amusie. Msch. f. Psychiat. u. Neur., 1927, 64, 354–368.

Klein, R. Denkinhalt und Aphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1929, 121, 36–70.

Klein, R. Ueber die Wortgestalt und ihren Bedeutungsinhalt bei Aphasikern. Zsch. f. d. ges. Neur. u. Psychiat., 1930, 129, 543–582.

Klein, R. Zur Symptomatologie des Parietallappens. Zsch. f. d. ges. Neur. u. Psychiat., 1931, 135, 589–608.

Klein, R. Ueber Leitungsaphasie. Msch. f. Psychiat. u. Neur., 1931, 80, 188–221.

Klein, R. Analyse eines Falles von schwerer Sprachtaubheit mit isoliert erhaltenem Lesen. Msch. f. Psychiat. u. Neur., 1931, 81, 210–226.

Klein, R. Ueber Apraxie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 147, 383–413.

Kleist, K. Gehirnpathologische und lokalisatorische Ergebnisse über Hörstörungen, Geräuschtaubheiten und Amusien. Msch. f. Psychiat. u. Neur., 1928, 68, 853–860.

Kleist, K. Gehirnpathologische und lokalisatorische Ergebnisse. 3. Mitteilung: Ueber sensorische Aphasien. J. f. Psychol. u. Neur., 1928, 37, 146–156.

Kleist, K. Gehirnpathologische und lokalisatorische Ergebnisse. 4. Mitteilung: Ueber motorische Aphasien. J. f. Psychol. u. Neur., 1930, 40, 338–346.

Kleist, K. Gehirnpathologie vornehmlich auf grund der Kriegserfahrungen. Reprinted from Handbuch der ärztlichen Erfahrungen im Weltkriege, 4, Teil 2. Leipzig: J. A. Barth, 1934. xv + (343–1408) pp.

Kostenitsch, J. Ueber einen Fall von motorischer Aphasie. Dtsch. Zsch. f. Nervenhk., 1893, 4, 369–376.

Kramer, F. Beitrag zur Lehre von der Alexie und der amnestischen Aphasie. Msch. f. Psychiat. u. Neur., 1928, 68, 346–360.

Kroll, M., and Stolbun, D. Was ist konstruktive Apraxie? Zsch. f. d. ges. Neur. u. Psychiat., 1933, 148, 142–158.

Kronfeld, A., and Sternberg, E. Der gedankliche Aufbau der klassischen Aphasieforschung im Lichte der Sprachlehre. Psychol. u. Med., 1927, 2, 254–295.

Kuenberg, M. von. Ueber das Erfassen einfacher Beziehungen an anschaulichem Material bei Hirngeschädigten, insbesondere bei Aphasischen. Zsch. f. d. ges. Neur. u. Psychiat., 1923, 85, 120–163.

Kuenberg, M. von. Zuordnungsversuche bei Gesunden und Sprachgestörten. Arch. f. d. ges. Psychol., 1930, 76, 257–352.

Kuttner, H. Beitrag zur Kenntnis der Rückbildungsvorgänge bei Aphasia totalis. Msch. f. Psychiat. u. Neur., 1928, 70, 287–303.

Kuttner, H. Ueber die Beteiligung der rechten Hirnhälfte an der Sprachfunktion. Arch. f. Psychiat. u. Nervenkh., 1930, 91, 691–693.

Ladame, P. L., and Monakow, C. von. Observation d'aphémie pure (anarthrie corticale). Encéphale, 1908, 3, 193–228.

Laignel-Lavastine and Alajouanine. Un cas d'agnosie auditive. Rev. neur., 1921, 37, 194–198.

Laignel-Lavastine and Valence. Grande aphasie de Wernicke avec déficit particulièrement marqué de la représentation spatiale. Bull. et mém. Soc. méd. d. hôp. de Paris, 1926, 50, 270–272.

Lalli, G. di. Contributo alla studio dell'afasia isterica. Ann. di nevrolog., 1930, 44, 81–90.

Lange, J. Fingeragnosie und Agraphie. Msch. f. Psychiat. u. Neur., 1930, 76, 129–188.

Lange, J. Analyse eines Falles von Lautagraphie. Msch. f. Psychiat. u. Neur., 1931, 79, 81–135.

Lange, J. Probleme der Fingeragnosie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 147, 594–610.

Langelüddeke, A. Rhythmus und Takt bei Gesunden und Geisteskranken. Zsch. f. d. ges. Neur. u. Psychiat., 1928, 113, 1–101.

Lashley, K. S. Basic Neural Mechanisms in Behavior. Psychol. Rev., 1930, 37, 1–24.

Lashley, K. S. Cerebral Control versus Reflexology. J. Gen. Psychol., 1931, 5, 3–20.

Lassignardie and Manine. Balle de shrapnell logée dans le lobe occipital gauche au voisinage du pli courbe. Hémianopsie latérale homonyme droite et cécité verbale. Ann. d'ocul., 1923, 160, 719–726.

Last, S. L. Ueber eine Störung der optischen Formauffassung. Msch. f. Psychiat. u. Neur., 1930, 76, 238–245.

Last, S. L. Beitrag zur psychopathologischen Analyse der optisch-agnostischen Störungen. Arch. f. Psychiat. u. Nervenkh., 1933, 99, 197–232.

Laubenthal, F. Zur psychologischen Analyse von Kranken mit einem Syndrom der linken Parieto-Occipitalgegend. Arch. f. Psychiat. u. Nervenkh., 1933, 99, 633–682.

Lebedinsky, M. S., and Luria, A. R. Die Methode der abbildenden Motorik in der Untersuchung der Nervenkranken. Arch. f. Psychiat. u. Nervenkh., 1929, 87, 471–497.

Lemos, M. Aphasie motrice pure, avec lésion corticale circonscrite. Rev. neur., 1900, 8, 744–745.

Leva, J. Zur Localisation der Aphasien. Virchow's Arch., 1893, 132, 333–353.

Levi, L., and Taguet. Cécité verbale pure avec hémianopsie homonyme latérale droite. Rev. neur., 1905, 13, 635–637.

Levy-Valensi, J. Apraxies. Nouveau traité de médecine, 18, 380–397. Paris: Masson et Cie., 1928.

Ley, A. Évolution favorable d'un cas d'alexie congénitale avec persistence de l'agraphie. J. de neur. et de psychiat., 1929, 29, 582–584.

Ley, A. and J. L'alexie et l'agraphie d'évolution. Etude de six cas. Encéphale, 1931, 26, 429–437.

Ley, J. Un cas d'audi-mutité idiopathique (aphasie congénitale) chez des jumeaux monozygotiques. Encéphale, 1929, 24, 121–165.

Ley, J. Les troubles de développement du langage. J. de neur. et de psychiat., 1930, 30, 415–457.

Lhermitte, J., Lévy, G., and Kyriako, N. Les perturbations de la représentation spatiale chez les apraxiques. Rev. neur., 1925, 2, 586–600.

Lhermitte, J., Massary, J. de, and Huguenin, R. Syndrome occipital avec alexie pure d'origine traumatique. Rev. neur., 1929, 2, 703–707.

Lhermitte, J., Massary, J. de, and Kyriako, N. Le rôle de la pensée spatiale dans l'apraxie. Rev. neur., 1928, 2, 895–903.

Lhermitte, J., and Trelles, J. O. Sur l'apraxie pure constructive, les troubles de la pensée spatiale et de la somatagnosie dans l'apraxie. Encéphale, 1933, 28, 413–444.

Liebmann, A. Die Behandlung der motorischen Aphasie. Psychiat.-Neur. Woch., 1931, 33, 55–56.

Liepmann, H. Das Krankheitsbild der Apraxie ("motorischen Asymbolie"). Berlin: S. Karger, 1900. 78 pp.

Liepmann, H. Drei Aufsätze aus dem Apraxiegebiet. Berlin: S. Karger, 1908. 80 pp.

Liepmann, H. Zum Stande der Aphasiefrage. Neur. Zbl., 1909, 28, 449–484.

Liepmann, H. Klinische und psychologische Untersuchung und anatomischer Befund bei einem Fall von Dyspraxie und Agraphie. Msch. f. Psychiat. u. Neur., 1929, 71, 169–214.

Liepmann, H., and Storch, E. Der mikroskopische Gehirnbefund bei dem Fall Gorstelle. Msch. f. Psychiat. u. Neur., 1902, 11, 115–120.

Lord, E. E. A Study of the Mental Development of Children with Lesion in the Central Nervous System, from the Yale Psycho-Clinic. Genetic Psychol. Monog., 1930, 7, 365–486.

Lotmar, F. Zur Kenntnis der erschwerten Wortfindung und ihrer Bedeutung für das Denken des Aphasischen. Schweiz. Arch. f. Neur. u. Psychiat., 1919, 5, 206–239.

Lotmar, F. Zur Pathophysiologie der erschwerten Wortfindung bei Aphasischen. Schweiz. Arch. f. Neur. u. Psychiat., 1933, 30, 86–158; 322–379.

Low, A. A. A Case of Agrammatism in the English Language. A Critical Study in Categorical Thought. Arch. Neur. & Psychiat., 1931, 25, 556–597.

Luria, A. R. The Nature of Human Conflicts, or Emotion, Conflict and Will. Translated by W. H. Gantt. New York: Liveright, 1932. xvii + 431 pp.

Mansfield, H. L. A Case of Congenital Auditory Aphasia Complicated by Amentia. Training School Bull., 1929, 25, 129–134.

Marburg, O. Vorstellung eines seltenen Falles von cerebraler Sprachstörung. Wien. klin. Woch., 1899, 12, 719.

Marie, P. Existe-t-il dans le cerveau humain des centres innés ou préformés de langage? Presse méd., 1922, 30, 177–181.

Marie, P., and Foix, Ch. Les aphasies de guerre. Rev. neur., 1917, 31, 53–87.

Marinesco, G., Grigoresco, D., and Axente, S. Aphasie croisée. Rev. belge sc. méd., 1932, 4, 123–130.

Marinesco, G., and Kreindler, A. Sprache, Aphasie und bedingte Reflexe. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 145, 127–164.

Massary, J. de. L'alexie. Encéphale, 1932, 27, 53–78; 134–164.

McBride, K. E. A Psychological Study of Aphasia. 1932. Unpublished thesis in the Library of Bryn Mawr College, Bryn Mawr, Pa.

McCready, E. B. Defects in the Zone of Language (Word-Deafness and Word-Blindness) and their Influence in Education and Behavior. Amer. J. Psychiat., 1926–27, 83, 267–277.

Meige, H. Troubles de l'élocution et de la prononciation. Dysphasies et dystomies. Nouveau traité de médecine, 18, 215–240. Paris: Masson et Cie., 1928.

Melten, A. W. A Note on the Relation between Brain Injury and Retentiveness. Psychol. Bull., 1931, 28, 175–180.

Mendel, M. Un cas d'alexie. Sem. méd., 1902, 22, 53.

Meyer, A. Examination for an Aphasic Patient. Copy on file in Phipps Clinic, Johns Hopkins Hospital, Baltimore, Md.

Meyer, A. The Relation of the Auditory Center to Aphasia. J. f. Psychol. u. Neur., 1908, 13, 203–213.

Meyer, A. The Present Status of Aphasia and Apraxia. Harvey Lectures, 1909–10. Philadelphia: Lippincott, 1910, 5, 228–250.

Mills, C. K. Aphasia and the Cerebral Zone of Speech. Amer. J. Med. Sci., 1904, 128, 375–393.

MILLS, C. K. Treatment of Aphasia by Training. J. A. M. A., 1904, 43, 1940–1949.

MILLS, C. K. Discussion on Aphasia, especially with Reference to the Views of Marie. J. Nerv. & Ment. Dis., 1907, 34, 459–473.

MILLS, C. K. The Different Theories of Aphasia. N. Y. Med. J., 1914, 99, 861–865.

MILLS, C. K. Cerebral Localization and Failures in Written Language. Arch. Neur. & Psychiat., 1929, 22, 1127–1134.

MILLS, C. K., and SPILLER, W. G. The Symptomatology of Lesions of the Lenticular Zone with some Discussion of the Pathology of Aphasia. J. Nerv. & Ment. Dis., 1907, 34, 558–588; 625–650.

MILLS, C. K., and WEISENBURG, T. H. Word-Blindness, with the Record of a Case due to a Lesion in the Right Cerebral Hemisphere in a Right-handed Man; with some Discussion of the Treatment of Visual Aphasia. Medicine, 1905, 11, 822–828.

MINKOWSKI, M. Klinischer Beitrag zur Aphasie bei Polyglotten, speziell im Hinblick auf das Schweizerdeutsche. Schweiz. Arch. f. Neur. u. Psychiat., 1927, 21, 43–72.

MINKOWSKI, M. Sur un cas d'aphasie chez un polyglotte. Rev. neur., 1928, 1, 361–366.

MISCH, W. Beitrag zur Lehre von der Alexie und amnestischen Aphasie. J. f. Psychol. u. Neur., 1928, 37, 223–232.

MISCH, W. Beitrag zur Lehre von der Alexie. Dtsch. Zsch. f. Nervenhk., 1928, 107, 160–164.

MISCH, W., and FRANKL, K. Beitrag zur Alexielehre. Msch. f. Psychiat. u. Neur., 1929, 71, 1–47.

MOEDE, W. Die Untersuchung und Uebung der Gehirngeschädigten nach experimentellen Methoden. Review in Zsch. f. angew. Psychol., 1917, 12, 525.

MONAKOW, C. VON. Die Lokalisation im Grosshirn. Wiesbaden: J. F. Bergmann, 1914. xii + 1026 pp.

MORSIER, G. DE. Contribution à l'étude anatomo-clinique de la fonction mnésique. Un cas de syndrome amnésique avec gliome du splénium du corps calleux. Schweiz. Arch. f. Neur. u. Psychiat., 1932, 28, 283–292.

MORSIER, G. DE. Quelques symptomes rares consécutifs aux traumatismes craniens: hyperesthésie cervicale, aphasie, mutisme, hallucination olfactive. Rev. d'oto-neuro-opht., 1932, 10, 682–683.

MORSIER, G. DE, and JENTZER, A. Alexie pure par gliome du lobe occipital gauche avec œdème précoce de tout l'hémisphère. Rev. d'oto-neuro-opht., 1932, 10, 409.

MOURGUE, R. Disorders of Symbolic Thinking due to Local Lesions of the Brain. Brit. J. Psychol., Med. Sec., 1921, 1, 97–124.

MOUTIER, F. L'aphasie de Broca. Paris: G. Steinheil, 1908. 774 pp.

Naville, F. Mémoires d'un médecin aphasique. Arch. de psychol., 1918, 17, 1–57.

Nayrac and Bataille. Sur un cas de surdité verbale pure. Echo méd. du nord, 1927, 31, 42–45.

Niessl von Mayendorf, E. Kritische Studien zur Methodik der Aphasielehre. Berlin: S. Karger, 1925. 108 pp.

Niessl von Mayendorf, E. Ueber neuere und neueste Errungenschaften der Aphasieforschung. Zsch. f. d. ges. Neur. u. Psychiat., 1927, 110, 189–203.

Niessl von Mayendorf, E. Ueber Seelenblindheit. Dtsch. Zsch. f. Nervenhk., 1928, 102, 117–122.

Niessl von Mayendorf, E. Vom Lokalisationsproblem der artikulierten Sprache. Leipzig: J. A. Barth, 1930. vii + 186 pp.

Niessl von Mayendorf, E. Beiträge zur Lehre von der Seelenblindheit: 1. Mitteilung. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 149, 68–102.

Niessl von Mayendorf, E. Zur Frage der sogennanten parietalen Aphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 147, 1–49.

Noica, D. Quel est le mécanisme de la paraphasie et de la jargonaphasie dans l'aphasie sensorielle? Rev. neur., 1926, 1, 227–250.

Noica, D. L'aphasie motrice. Encéphale, 1927, 22, 786–795.

Noica, D. La mémoire de prononciation dans l'aphasie motrice. J. de neur. et de psychiat., 1929, 29, 201–207.

Noica, D. Sur le "déficit intellectual spécialisé" dans l'aphasie sensorielle de Wernicke. J. de neur. et de psychiat., 1929, 29, 331–338.

Noica, D. Observation d'un malade dont le diagnostic a été: "Aphasie motrice" et à l'autopsie duquel on a trouvé des lésions lacunaires de paralysie pseudobulbaire; observation d'un second malade chez qui on n'a constaté aucun trouble d'aphasie et à l'autopsie duquel on a trouvé une lésion dans la troisième frontale, dont le pied est conservé. J. de neur. et de psychiat., 1930, 30, 70–74.

Nicolle, Ch., and Halipre, A. L'écriture en miroir. Cécité verbale pure et centre de l'agraphie. Presse méd., 1895, 2, 148–149.

Ombredane, A. Sur le mécanisme de l'anarthrie et sur les troubles associés du langage intérieur. J. de psychol., 1926, 23, 940–955.

Ombredane, A. Le langage. Nouveau traité de psychologie, 3, 361–458. Paris: Félix Alcan, 1933.

Orlando, R., and Orosco, G. Afasia de Broca. Sem. méd., 1928, 2, 1457–1465.

Osnato, M. Aphasia and Associated Speech Problems. New York: P. B. Hoeber, 1920. xiii + 191 pp.

Osnato, M. Speech, its Development and Integration with the Intelligence. Neur. Bull., 1921, 3, 47–63.

Paterson, J. V., and Bramwell, E. Two Cases of Word-Blindness. Med. Press and Circ., 1905, 79, 507–508.

Pearson, G. H. J., Alpers, B. J., and Weisenburg, T. Aphasia. A Study of Normal Control Cases. Arch. Neur. & Psychiat., 1928, 19, 281–295.

Peters, W. Psychologie und Hirnverletztenfürsorge. Zsch. f. angew. Psychol., 1918, 14, 75–89.

Pick, A. Studien über motorische Apraxie. Leipzig and Wien: Franz Deuticke, 1905. 129 pp.

Pick, A. Schwere Denkstörung infolge einer Kombination perseveratorischer, amnestisch-aphasischer und kontaminatorischer Störungen. Zsch. f. d. ges. Neur. u. Psychiat., 1922, 75, 309–322.

Pick, A. Sprachpsychologische und andere Studien zur Aphasielehre. Schweiz. Arch. f. Neur. u. Psychiat., 1923, 12, 105–135.

Pick, A. Des formulations verbales accompagnant les mouvements et les actions. J. de psychol., 1923, 20, 885–894.

Pick, A., and Thiele, R. Aphasie. Handb. d. norm. u. path. Physiol., 15, Teil 2, 1416–1524. Berlin: Julius Springer, 1931.

Piéron, H. Thought and the Brain. Translated by C. K. Ogden. New York: Harcourt, Brace, 1927. xiv + 262 pp.

Poliak, S. The Main Afferent Fiber Systems of the Cerebral Cortex in Primates. Berkeley, Cal.: University of California Press, 1932. xiv + 370 pp. Reviewed by O. Strong, Arch. Neur. & Psychiat., 1934, 31, 635–651.

Pollak, E., and Schilder, P. Zur Lehre von den Sprachantrieben. Zsch. f. d. ges. Neur. u. Psychiat., 1926, 104, 480–502.

Ponitz, K. Die paralytische Sprachstörung, ihre klinische Differenzierung und Beeinflussung durch Behandlung. Msch. f. Psychiat. u. Neur., 1931, 80, 1–14.

Poppelreuter, W. Ueber psychische Ausfallserscheinungen nach Hirnverletzungen. Münch. med. Woch., 1915, 62, 1, 489–491.

Poppelreuter, W. Die psychischen Schädigungen durch Kopfschuss. Leipzig: Leopold Voss, 1917–18. 2 vols., viii + 473 and xvi + 210 pp.

Poppelreuter, W. Zur Psychologie und Pathologie der optischen Wahrnehmung. Zsch. f. d. ges. Neur. u. Psychiat., 1923, 83, 26–152.

Pötzl, O. Ueber die parietal bedingte Aphasie und ihren Einfluss auf das Sprechen mehrerer Sprachen. Zsch. f. d. ges. Neur. u. Psychiat., 1925, 96, 100–124.

Pötzl, O. Zur Kasuistik der Wortblindheit-Notenblindheit. Msch. f. Psychiat. u. Neur., 1927, 66, 1–12.

Pötzl, O. Einiges zur Symptomatologie der temporalen Aphasien. Msch. f. Ohrenhk. u. Laryngo.-Rhinol., 1928, 62, 868–875.

Pötzl, O. Die Aphasielehre vom Standpunkte der klinischen Psychiatrie. Die optisch-agnostischen Störungen. Handb. d. Psychiat. hrsg. v. Aschaffen-

burg. Spez. Teil, Abt. 3, Hälfte 2. Leipzig: Franz Deuticke, 1928. 358 pp.

Pötzl, O. Aphasie und Mehrsprachigkeit. Zsch. f. d. ges. Neur. u. Psychiat., 1930, 124, 145–162.

Pötzl, O. Zum gegenwärtigen Stand der Aphasielehre. Wien. med. Woch., 1932, 82, 1, 783–791.

Poussepp, L. Contribution aux recherches sur la localisation de l'aphasie visuelle. Presse méd., 1923, 31, 1, 564–565.

Quadfasel, F. Ein Beitrag zum motorischen Verhalten Aphasischer. Klinische Untersuchungen mit dem Hand-Auge-Ohrtest Heads. Msch. f. Psychiat. u. Neur., 1931, 80, 151–188.

Quensel, F. Ein Fall von rechtsseitiger Hemianopsie mit Alexie und zentral bedingtem monokulärem Doppeltsehen. Msch. f. Psychiat. u. Neur., 1927, 65, 173–207.

Quensel, F. Erkrankungen der höheren optischen Zentren. Kurzes Handb. d. Ophthalmologie, 6, 324–475. Berlin: Julius Springer, 1931.

Ranschburg, P., and Schill, E. Ueber Alexie und Agnosie. Zsch. f. d. ges. Neur. u. Psychiat., 1932, 139, 192–240.

Rawak, F. Zur Klinik der Agraphie. Arch. f. Psychiat. u. Nervenkh., 1933, 99, 773–803.

Redlich, E. Ueber die sogenannte subcortikale Alexie. Jahrb. f. Psychiat. u. Neur., 1895, 13, 243–302.

Rieger, C. Beschreibung der Intelligenzstörungen in Folge einer Hirnverletzung, nebst einem Entwurf zu einer allgemein anwendbaren Methode der Intelligenzprüfung. Würzburg: Stahel'schen Univers.-Buch.- u. Kunsthandlung, 1888. 126 pp.

Riese, W. Ueber den Entstehungsmechanismus der Wortneubildungen bei Amnestisch-Aphasischen. Msch. f. Psychiat. u. Neur., 1928, 68, 507–514.

Robertson, A. The Pathology of Aphasia. J. Ment. Sci., 1867, 12, 503–521.

Rothmann, E. Untersuchung eines Falles von umschriebener Hirnschädigung mit Störungen auf verschiedensten Leistungsgebieten. Schweiz. Arch. f. Neur. u. Psychiat., 1934, 33, 35–70; 228–241.

Rothschild, K. The Relation of Broca's Center to Lefthandedness. Amer. J. Med. Sci., 1931, 182, 116–118.

Sapir, I. D. Die Neurodynamik des Sprachapparates bei Aphasikern. J. f. Psychol. u. Neur., 1929, 38, 91–116.

Schaffer, K. Beitrag zur Insel-Linsenkernaphasie. J. f. Psychol. u. Neur., 1930, 40, 180–189.

Schaffer, K. Ueber das Verhältnis der amnestischen Aphasie zu Kurt Goldstein's "kategorialem Verhalten." Arch. f. Psychiat. u. Nervenkh., 1933, 100, 427–431.

Scheller, H., and Seidemann, H. Zur Frage der optisch-räumlichen Agnosie. Msch. f. Psychiat. u. Neur., 1931, 81, 97–188.

Schilder, P. Fingeragnosie, Fingerapraxie, Fingeraphasie. Nervenarzt, 1931, 4, 625–629.

Schilder, P., and Stengel, E. Asymbolia for Pain. Arch. Neur. & Psychiat., 1931, 25, 598–600.

Schlesinger, B. Zur Auffassung der optischen und konstruktiven Apraxie. Zsch. f. d. ges. Neur. u. Psychiat., 1928, 117, 649–697.

Schlesinger, B. Einige Bemerkungen zu der Arbeit von *Zutt:* Rechts-Links-Störung, konstruktive Apraxie und reine Agraphie. Msch. f. Psychiat. u. Neur., 1932, 84, 238–242.

Schuster, P., and Taterka, H. Beitrag zur Anatomie und Klinik der reinen Worttaubheit. Zsch. f. d. ges. Neur. u. Psychiat., 1926, 105, 494–538.

Schuster, P., and Taterka, H. Zur Klinik der Seelenblindheit. Dtsch. Zsch. f. Nervenhk., 1928, 102, 112–117.

Schwab, O. Ueber vorübergehende aphasische Störungen nach Rindenexcision aus dem linken Stirnhirn bei Epileptikern. Dtsch. Zsch. f. Nervenhk., 1926, 94, 177–184.

Scollo, G. Sulla afasia motoria di Broca. Policlinico (sez. prat.), 1926, 33, 437–441.

Scripture, E. W. Studies in Speech Neurology. J. Neur. & Psychopathol., 1930, 11, 156–162.

Siekmann, W. Psychologische Analysen hirnpathologischer Fälle. XIV. Psychologische Analyse des Falles Rat . . . . Psychol. Forsch., 1932, 16, 201–250.

Singer, H. D., and Low, A. A. The Brain in a Case of Motor Aphasia in which Improvement occurred with Training. Arch. Neur. & Psychiat., 1933, 29, 162–165.

Singer, H. D., and Low, A. A. Acalculia (Henschen). A Clinical Study. Arch. Neur. & Psychiat., 1933, 29, 467–498.

Sittig, O. Ueber Echographie. Msch. f. Psychiat. u. Neur., 1928, 68, 574–604.

Sittig, O. Ueber Apraxie. Zbl. f. d. ges. Neur. u. Psychiat., 1929, 53, 429–432.

Sittig, O. Ueber apraktische Agraphie. Arch. f. Psychiat. u. Nervenkh., 1930, 91, 470–473.

Sittig, O. Ueber Apraxie. Eine klinische Studie. Berlin: S. Karger, 1931. 248 pp.

Sittig, O. Kasuistischer Beitrag zur Lehre von den fokalen Lähmungen nebst Bemerkungen über Apraxie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 147, 308–315.

Souques, A. Physiologie pathologique de l'aphasie comitiale transitoire. Rev. neur., 1928, 1, 411–415.

Souques, A. Quelques cas d'anarthrie de Pierre Marie. Rev. neur., 1928, 2, 319–368.

Souques, A., and Baruk, H. Autopsie d'un cas d'amusie (avec aphasie) chez un professeur de piano. Rev. neur., 1930, 1, 545–556.

Spearman, C. The Abilities of Man. New York: Macmillan, 1927. xxxiii + 415 pp.

Stengel, E. Zur Rückbildung der motorischen Aphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1931, 134, 1–23.

Stengel, E. Zur Lehre von der Leitungsaphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 149, 266–291.

Stengel, E., and Zelmanowicz, J. Ueber polyglotte motorische Aphasie. Zsch. f. d. ges. Neur. u. Psychiat., 1933, 149, 292–311.

Stertz, G. Ueber subkortikale sensorische Aphasie nebst einigen allgemeinen Bemerkungen zur Auffassung aphasischer Symptome. Msch. f. Psychiat. u. Neur., 1912, 32, 327–365.

Stertz, G. Ueber die Leitungsaphasie. Beitrag zur Auffassung aphasischer Störungen. Msch. f. Psychiat. u. Neur., 1914, 35, 318–359.

Stockert, F. G. von. Das Gerstmannsche Syndrom der Fingeragnosie mit besonderer Berücksichtigung der Sprach- und Schreib-Störung. Msch. f. Psychiat. u. Neur., 1934, 88, 121–151.

Storch, E. Zwei Fälle von reiner Alexie. Msch. f. Psychiat. u. Neur., 1903, 13, 499–531.

Störring, G. E. Der Arbeitsschreiberversuch als klinische Hilfsmethode zur Diagnose von Hirnschädigungen. Msch. f. Psychiat. u. Neur., 1932, 82, 313–327.

Strauss, H. Ueber konstruktive Apraxie. Msch. f. Psychiat. u. Neur., 1924, 56, 65–124.

Strümpell, A. von. Die Entwicklung der Sprache und die aphatischen Sprachstörungen. Zsch. f. pädagogische Psychol., 1916, 17, 5–21.

Thiele, R. Aphasie, Apraxie, Agnosie. Handb. d. Geisteskrankh., hrsg. v. O. Bumke, 2, Allgem. Teil 2, 243–365. Berlin: Julius Springer, 1928.

Thiele, R. Aphasie, Apraxie, Agnosie. Fortschr. d. Neur., Psychiat. u. ihr. Grenzgeb., 1929, 1, 483–492.

Thomas, A. De la rééducation dans l'alexie. Clinique, 1906, 1, 86.

Thorndike, E. L. Intelligence and its Uses. Harpers Magazine, 1920, 140, 227–235.

Thorndike, E. L., *et al.* Adult Learning. New York: Macmillan, 1928. x + 335 pp.

Thurstone, L. L. The Vectors of Mind. Psychol. Rev., 1934, 41, 1–32.

TRYON, R. C. Multiple Factors vs. Two Factors as Determiners of Abilities. Psychol. Rev., 1932, 39, 324–351.

TRYON, R. C. So-called Group Factors as Determiners of Abilities. Psychol. Rev., 1932, 39, 403–439.

URBANTSCHITSCH, E. Zur Wort- und Melodientaubheit. Wien. klin. Woch., 1927, 40, 726–728.

USNADZE, D. Ein experimenteller Beitrag zum Problem der psychologischen Grundlagen der Namengebung. Psychol. Forsch., 1924, 5, 24–43.

VALKENBURG, C. F. VAN. Zur Psychologie der Aphasie. Schweiz. Arch. f. Neur. u. Psychiat., 1923, 12, 3–27.

VALKENBURG, C. F. VAN. Zur Pathologie mnestischer Störungen allgemeiner und besonderer Natur (Farbensinn) nach Hirntrauma. Schweiz. Arch. f. Neur. u. Psychiat., 1929, 23, 266–283.

VERNET, P., and MERLAND, A. Un cas d'aphasie totale. Suppression de toutes les fonctions symboliques. Apparence démentielle. Absence d'affaiblissement intellectuel réel. Bull. de la Soc. clin. de méd. ment., 1922, 10, 230–234.

VINCENT, C., DAVID, M., and PUECH, P. Sur l'alexie: Production du phénomène à la suite de l'extirpation de la corne occipitale du ventricule latéral gauche. Rev. neur., 1930, 1, 262–272.

WAGNER, W. Ueber Raumstörung. Msch. f. Psychiat. u. Neur., 1932, 84, 281–307.

WAGNER, W., and MAYER, K. Psychologische Untersuchung an der Sprachstörung einer Zwölfjährigen. Msch. f. Psychiat. u. Neur., 1933, 87, 108–155.

WEISENBURG, T. H. A Study of Aphasia. The Charles K. Mills Memorial Lecture. Arch. Neur. & Psychiat., 1934, 31, 1–33.

WELLS, F. L. Linguistic Lapses with Especial Reference to the Perception of Linguistic Sounds. Arch. of Philos., Psychol. and Sci. Meth., 1906, No. 6. 110 pp.

WELLS, F. L. Aphasic Performance in the Terman Vocabulary Test. J. Educ. Psychol., 1917, 8, 483–487.

WELLS, F. L. Mental Tests in Clinical Practice. Yonkers: World Book Co., 1927. x + 315 pp.

WILSON, S. A. K. Discussion on Aphasia. Brain, 1920, 43, 412–450.

WILSON, S. A. K. An Introduction to the Study of Aphasia. Lancet, 1921, 2, 1143–1147.

WILSON, S. A. K. Aphasia. London: Kegan Paul, Trench, Trubner & Co., Ltd., 1926. 108 pp.

WOERKOM, W. VAN. La signification de certains éléments de l'intelligence dans la genèse des troubles aphasiques. J. de psychol., 1921, 18, 730–751.

WOERKOM, W. VAN. Sur l'état psychique des aphasiques. Encéphale, 1923, 18, 286–304.

WOERKOM, W. VAN. Ueber Störungen im Denken bei Aphasie Patienten. Msch. f. Psychiat. u. Neur., 1925, 59, 256–322.

WOERKOM, W. VAN. Psychopathologische Beobachtungen bei Stirnhirngeschädigten. Msch. f. Psychiat. u. Neur., 1931, 80, 274–331.

WOLPERT, I. Ueber Störungen des Sprachverständnisses. Dtsch. Zsch. f. Nervenhk., 1929, 111, 187–191.

WOLPERT, I. Störung der Orientierung im Raume. Zbl. f. d. ges. Neur. u. Psychiat., 1930, 55, 786–787.

WOLPERT, I. Ueber das Wesen der literalen Alexie. Beitrag zur Aphasielehre. Msch. f. Psychiat. u. Neur., 1930, 75, 207–266.

WORSTER-DROUGHT, C., and ALLEN, I. M. Congenital Auditory Imperception (Congenital Word-Deafness): with Report of a Case. J. Neur. & Psychopath., 1929, 9, 193–208.

WORSTER-DROUGHT, C., and ALLEN, I. M. Congenital Auditory Imperception (Congenital Word-Deafness): and its Relation to Idioglossia and other Speech Defects. J. Neur. & Psychopath., 1930, 10, 193–236.

ZUCKER, K. Ueber die pathologischen Funktionen bei amnestischer Aphasie. Msch. f. Psychiat. u. Neur., 1933, 87, 65–107; 193–252.

ZUCKER, K. An Analysis of Disturbed Function in Aphasia. Brain, 1934, 57, 109–127.

ZUTT, J. Rechts-Linksstörung, konstruktive Apraxie und reine Agraphie. Darstellung eines Falles. Ein Beitrag zur Pathologie der Handlung. Msch. f. Psychiat. u. Neur., 1932, 82, 253–305; 355–395.

ZUTT, J. Erwiderung auf die vorstehenden Bemerkungen Schlesingers. Msch. f. Psychiat. u. Neur., 1932, 84, 242–244.

INDEX

Abelson's Geometrical Figures, 573
Absurdities tests, 136, 573, 587–588
Ach, N., 46, 100
Adrian, E. D., 468
Agnosia, 5, 18, 27, 37, 38, 53, 100, 116, 464
  auditory, 63, 106
  authors' use of term, 338–339, 363
  case showing, 344–359
  close relation to apraxia, 101–102, 112–114, 344, 467
  color agnosia, 108, 109–110
  finger agnosia, 44, 108
  localization of lesion in, 101–102, 107
  nature of, 110–111, 115–116, 359–363, 467
  psychic blindness, 107, 110–111
  results of tests for, 284–285, 353–357
  tactile, 106, 339
  tests for, 102–103, 594–595
  types of, 101, 106–108, 108–111, 466
  visual, 65, 67, 69–70, 106–108
  visual-spatial, 108
Agrammatism, 21, 33, 50, 53, 60–61, 152
  case showing, 483–491
  See also Expressive aphasia, expressive disturbances in
Agraphia, 30, 33, 52, 60, 142, 432, 463
  See also Writing, disturbances of
Alexia. *See* Word-blindness
Alpers, B. J., 91
Amnesic aphasia, 32, 33, 44, 50, 53, 54, 55, 67, 74–75, 78, 110, 143–144, 148, 149, 153, 216, 217, 441, 462, 464, 465–466, 472
  cases of, 126, 127, 128, 302–316, 318–319, 556–566
  expressive disturbances in, 299–300
  general behavior in, 301
  localization of lesion in, 81–82, 305, 318, 450, 468, 473
  nature of, 40, 46, 79–81, 146–147, 299–300, 430, 459–460, 466
  non-language performances in, 301
  recognition of words heard or read, 300
Amusia. *See* Motor amusia; Sensory amusia
Analogies tests, 110, 136, 153, 334, 583–586
Anarthria, 20, 21, 22, 23, 54, 56, 432, 464
Anatomical studies. *See* Pathological studies
Aphemia, 8–9, 30, 54, 142, 464
  See also Motor aphasia
Apractognosia, 112
Apraxia, 5, 17–18, 30, 37, 38, 53, 100, 116, 281, 464
  authors' use of term, 338–339, 363
  cases showing, 339–343, 344–359
  close relation to agnosia, 101–102, 112–114, 344, 467
  constructive, 104, 105–106, 109, 112–115, 340, 434
  ideational, 104, 105, 111–112, 341, 342
  ideokinetic, 104–105, 111–112, 340, 345
  limbkinetic, 104, 111
  localization of lesion in, 101–102, 104–106, 343, 347
  nature of, 111–112, 115–116, 359–363, 467
  results of tests for, 284–285, 349–353, 355–357
  tests for, 102–103, 344
  types of, 103–106, 108–110, 343, 466
  visual, 105, 112, 113
Apraxic theory of aphasia, 34, 37–38, 104
Arithmetic
  in cases of right-sided lesion without aphasia, 324–326, 329
  disturbances of, 21, 30, 43, 44, 49, 60, 278; pronounced cases of, 195–211
  tests of, 135, 136, 580–581, 596–598
Articulate language, center for. *See* Cerebral centers, articulate language
Articulate speech, disturbances of. *See* Aphemia; Motor aphasia; Expressive aphasia
Astereognosis, 106, 339
Asymbolia
  motor. *See* Apraxia
  sensory. *See* Agnosia
Auditory agnosia, 63, 106
Auditory control of the speech process, 10, 32, 72
Auditory verbal memory test, 590
Auditory word center. *See* Cerebral centers, auditory speech
Automatic responses, disturbances of, 115–116, 339, 363, 416–418, 431–433
Automatic speech. *See* Automatic word series; Emotional speech; Reactive speech

Automatic word series, 149, 276, 299, 415, 417
  tests of, 135, 567–568
Automatic written responses, 277, 417–418
Autotopognosia, 108
Awareness of errors, 150–151, 219

Ballard, P. B., 587
Banti, G., 57
Bard, L., 67
Barr Scale, 125, 126–129, 331, 333
Barrett, A. M., 64
Baruk, H., 68
Basic English, 388
Bastian, H. C., 9–10, 13, 24, 57
Behavior, general characteristics of, in cases of aphasia, 40, 222, 281, 301, 426–429, 459, 473–474
Benary, W., 85, 110
Beringer, K., 68, 69–70
Bianchi, L., 28
Binet, A., 571
Boinet, M., 56
Bonhoeffer, K., 29, 61, 96
Bonvicini, G., 28, 29, 58, 63, 64, 67, 71, 76, 82, 114
Botcazo, 67
Bouillard, J., 7
Bouman, L., 39, 44, 46, 246, 434, 462
Bramwell, E., 67
Brissaud, E., 66–67
Broadbent, W. H., 24
Broca, P., 1, 7, 8–9, 54, 444, 461, 464
Broca's aphasia. *See* Aphemia; Motor aphasia
Broca's center. *See* Cerebral centers, articulate language

Cancellation, test of, 595
Categorical behavior, disturbances of. *See* Goldstein, K., on amnesic aphasia
Centers for language functions. *See* Cerebral centers
Central aphasia. *See* Goldstein, K., on central aphasia
Central form of motor aphasia. *See* Goldstein, K., on motor aphasia
Cerebral centers, 1, 25, 29, 52, 466
  articulate language, 8, 10, 24, 55
  auditory speech, 9, 10, 24–25
  calculation, 30
  naming, 24, 32
Cerebral centers (*cont.*):
  visual speech, 9, 24
  writing, 24, 30
Cerebral dominance. *See* Handedness, in relation to location of lesion
Cerebral functioning, 435–436, 446–447, 451, 468–470
  See also Localization
Cerebral localization. *See* Localization
Chapman Reading-Comprehension Test, 135, 576
Charcot, J. M., 57
Classification of aphasic disorders, 4, 47, 142–144, 462, 472
Color agnosia, 108, 109–110
Color-sorting experiments, 79–80
Conduction aphasia, 11, 32, 53, 54, 76–78, 465
Conrad, K., 39, 45
Consistency in response, 214, 295, 376–377, 413–415
Constructive apraxia, 104, 105–106, 109, 112–115, 340, 434
Control groups, 119–121, 130, 455
  cases of unilateral cerebral lesion without aphasia, 4, 5, 121, 122–123, 124, 125, 130, 322–336, 452–453, 470
  normal adults, 3–4, 121–124, 125, 130, 338, 471–472
Controlled association tests. *See* Analogies tests; Opposites tests
Copying, test of, 580
Cortical motor aphasia. *See* Motor aphasia
Cortical sensory aphasia. *See* Sensory aphasia
Course of the aphasic disorder, 24, 96–97, 367, 472
  in individual cases, 177, 190–194, 196, 231–232, 238, 291, 302, 378–380, 381–382, 393–395, 476, 491–492, 508–509, 514, 527, 539, 546, 565
  in relation to extent of pathology, 368–375, 450
  in relation to type of disorder, 366, 367–376, 378, 381–382, 450
  See also Deterioration; Improvement in aphasia

Dana, C. L., 98
Dandy, W. E., 561
Dejerine, Madame, 23
Dejerine, J., 22, 23, 25, 52, 57, 66, 67, 78
Delacroix, H., 50–51

Dercum, F. X., 25
Deterioration, 376
  cases showing, 189–194, 237–263, 302–316, 365–367, 373–375, 381–383, 526–535, 538–546, 556–560
  changes in type of disorder with, 96
  correspondence in neurological and psychological conditions with, 373–375, 383
  said to reverse course of development, 96–97, 221, 438, 459–460
Diaschisis, theory of, 94
Dickinson, 57
Dictation tests. *See* Morrison McCall Spelling Scale; Stanford Achievement Dictation Test
Dide, M., 67
Digit-symbol substitution tests, 136, 591
Drawing
  disturbances of, 48–49, 114, 115. *See also* Non-language performances, disturbances of
  quality of, in different cases, 361–362
  tests of, 136, 592–594
Drawing a chair, test of, 136, 592–593
Dufour, H., 58
Dürk, J., 84
Dysarthria, 30

Echolalia, 76
Education, data on, 124, 125, 126–129, 130–131, 324, 328
Ehrenwald, H., 68
Elaboration disorders in aphasia, 27
Elder, W., 67
Emissive disorders. *See* Expressive aphasia
Emotional speech, 12–13, 148–149, 152, 276, 277, 415, 417, 460
Emotionalism, cases showing, 222–236, 510–513
Engerth, G., 114
Ewing, A. W. G., 63
Expressive aphasia, 26–27, 51, 54, 118, 143, 144, 275, 299, 366, 462, 463, 464–465, 472
  cases of, 126–129, 154–182, 183–188, 189–194, 195–211, 392–407, 475–513
  expressive disturbances in, 148–152, 216
  language intelligence in, 153, 222
  nature of, 145, 153–154, 182–183
  non-language performances in, 153
  receptive disturbances in, 153
Expressive aphasia (*cont.*):
  relative severity of disturbances of speaking and writing in, 152, 182–183, 195
  in tumor cases, 317–318, 320–321
  See also Motor aphasia
Expressive-receptive aphasia, 143, 144, 366, 462, 464, 465, 472
  cases of, 126–128, 281–297, 546–555
  in a case showing apraxia and agnosia, 344–359
  expressive disturbances in, 275–277
  general behavior in, 281
  nature of, 146, 275
  non-language performances in, 279–281, 465
  receptive disturbances in, 278
  relative severity of disturbances in, 277–279
  in tumor cases, 318
External speech, 16
Extrinsic disorders in aphasia, 27

Feist, G. H., 59
Feuchtwanger, E., 117–118
Finger agnosia, 44, 108
Finkelnburg, F. C., 101
Fischer, S., 46
Flourens, M. J. P., 7
Flynn, J. C., 498
Foerster, O., 62, 95–96
Foix, C., 23, 29
Foreign languages, aphasic disturbances in, 161, 175–177
Formboards. *See* Non-language performances, tests of
Fox, C., 89
Frazier, C. H., 98, 293, 502, 539, 556
Freud, S., 101
Fritsch, G., 7
Fundamental disorder, presence of, in aphasia, 34, 39–45, 182, 431, 433–435, 459

Gall, F. J., 7
Gates Oral Spelling Test, 135, 332, 334, 579–580
Gates reading tests, 135, 571–572, 573–574, 575–576, 589, 595
Gehuchten, P. van, 64
Gelb, A., 40, 79, 102, 108, 110
Geometric sense, disturbance of, 43, 59
Gerstmann, J., 44, 60

Gerstmann's syndrome. *See* Parietal syndrome
Gestalt blindness, 110
Gestalt psychology, 39, 446
Gestaltstörung in aphasia. *See* Fundamental disorder, presence of, in aphasia
Gesture, disturbance of, in aphasia, 17, 21
Global aphasia. *See* Total aphasia; Expressive-receptive aphasia
Goldscheider, A., 98
Goldstein, K., 8, 27, 29, 31, 54, 61, 447, 448, 457, 462
  on agnosia, 108, 110
  on amnesic aphasia, 40, 46, 78–82, 459, 466
  on amusia, 117
  on central aphasia, 74, 78, 465
  on improvement, 94–96
  on localization, 40–42, 55
  on motor aphasia, 59, 62
  on the nature of aphasia, 39–40, 44, 45, 458
  on pure motor aphasia, 56, 57–58
  on reeducation, 98, 99, 387, 390
  on sensory aphasia, 72–73, 76
  tests for aphasia, 84–85, 102
  on word-blindness, 65
Goodenough Drawing Test, 136, 331, 593–594
Göpfert, H., 98, 99
Gordon, 89
Goris, 64
Grammatical confusions. *See* Receptive aphasia, expressive disturbances in
Grant, F. C., 448, 511, 528, 560
Gray Oral Reading Tests, 135, 333, 574
Group factor theory, 439–440
Grubel, R., 77
Grünbaum, A. A., 39, 44, 46, 102, 112, 115, 246, 434, 462, 467
Gutzmann, H., 98

Hand, Ear, and Eye Test. *See* Head, H., tests for aphasia
Handedness
  determination of, 322, 594
  forced change of, 391
  in relation to location of lesion, 124, 317, 318, 322, 435, 451–452, 468
Hartmann, F., 68
Hauptmann, A., 79, 81–82
Head, H., 8, 10, 19, 28, 31, 47, 72, 73, 96, 102, 448
Head, H. (*cont.*):
  on classification, 47, 143, 464; criticism of, 49–51, 462–463, 465
  on localization, 49, 468
  on the nature of aphasia, 34, 35–36, 38, 39, 40, 49, 56, 59, 86, 92, 430, 458–459, 462–463; criticism of, 430–431, 458–459
  on nominal aphasia, 48, 50–51, 54
  rejection of pure types of aphasia, 35, 38, 47, 52, 53, 56, 104, 463
  on semantic aphasia, 48–49, 50–51, 54
  on syntactical aphasia, 48, 50–51, 54
  tests for aphasia, 2, 86–87, 135, 568, 573; criticism of, 87–91, 458
  on verbal aphasia, 48, 50–51, 54, 59
  on vigilance, 36–37, 42
Heilbronner, K., 78, 101
Heiligtag, F., 67
Henneberg, R., 64
Henschen, S. E., 28, 29–31, 52, 55, 56, 64, 116–117, 457
Herrmann, G., 60
Hilpert, P., 77, 78
Hinschelwood, J., 66
Hitzig, E., 7
Hochheimer, W., 110
Huguenin, R., 68
Hysterical aphasia, 34

Ideational apraxia, 104, 105, 111–112, 341, 342
Idelsohn, H., 58
Ideokinetic apraxia, 104–105, 111–112, 340, 345
Imagery, 424, 436–437
Imitation tests. *See* Non-language performances, tests of
Imperception. *See* Agnosia
Impressive aphasia. *See* Receptive aphasia
Improvement in aphasia, 92–97, 367, 380–381, 452
  cases showing, 154–182, 183–188, 189–194, 195–211, 222–236, 237–263, 290–297, 365–366, 369–372, 377–381, 382, 392–407, 475–483, 491–510, 526–535, 564–566
  correspondence of, in neurological and psychological conditions, 369–372, 377–378
  type of disorder said to change with, 62, 63, 76, 78, 96, 381
  See also Reeducation in aphasia

Inferior speech. *See* Emotional speech; Reactive speech
Inflection, disturbances of, 149–150, 216
Ingham, S. D., 98
Inner speech, 16, 62, 66, 73, 464
  disturbances of, 21, 77
Innervatory apraxia. *See* Limbkinetic apraxia
Insight, disturbances of, 428
Intelligence, hypotheses of, 439–440
Intelligence in aphasia, 18–19, 20–22, 36, 37, 70, 71, 75–76, 110, 141, 153, 221, 278, 300, 433–434, 436, 437–438, 440–441, 460–462
  See also Psychological changes in aphasia
Interest
  as a factor in the patient's performance, 415–416
  preservation of, 427
Internal speech. *See* Inner speech
Intrinsic disorders in aphasia, 26–27
Isserlin, M., 29, 46, 61, 77, 79–80, 465

Jackson, J. H., 7–8, 11, 14, 16, 20, 24, 51, 55, 73, 111, 416, 444
  on apraxia, 17–18, 100–101, 115
  on imperception, 18, 100–101
  on inferior speech responses, 12–13, 14–15, 414, 415, 436, 460
  on localization, 1, 14–15, 17, 28, 467
  on nature of aphasia, 13, 18–19, 34, 35
  on propositional speech, 13–16, 73
  on right hemisphere, function of, 14–15, 16–17, 95, 417, 453, 469
  on types of aphasia, 11–12
  work, evaluation of, 19
Jaederholm Classification Test, 599
Jargon speech, 12, 15, 72
Jellinek, A., 118

Kelley, T. L., 439–440
Kelley-Trabue Completion Exercise, 136, 153, 217, 329, 331, 332, 379, 409, 586–587
Klein, R., 29, 39, 45, 46, 60, 77, 100, 115, 458, 462, 467
Kleist, K., 29, 31–33, 56, 61, 62, 70, 102, 103, 104–106, 107, 108, 109–110, 112–113 116–117, 327, 434, 448, 465, 466, 468, 469
Kostenitsch, J., 57
Kramer, F., 69
Kroll, M., 113
Kuenburg, M. von, 46, 79–80
Kuhlmann Comprehension Tests, 573
Kuhlmann line drawings, 568–569
Kuhlmann Test of Immediate Recall, 592
Kussmaul, A., 73

Ladame, P. L., 58
Lalli, G. di, 34
Lange, J., 39, 45, 60, 114, 458, 462, 467
Language intelligence
  in cases of right-sided lesion without aphasia, 324–326, 329
  tests of, 136, 153, 300, 581–589, 599
  See also Intelligence in aphasia
Laubenthal, F., 45
Learning, experimental studies of, 100
Leavitt, F. H., 549
Left hemiplegics. *See* Control groups, cases of unilateral cerebral lesion without aphasia
Leva, J., 57–58
Levi, L., 67
Lhermitte, J., 68, 114, 466
Lichtheim, L., 76
Liepmann, H., 34, 37–38, 61, 64, 101, 104–105, 111, 112, 113
Limbkinetic apraxia, 104, 111
Lissauer, W., 107
Literal alexia. *See* Word-blindness
Lloyd, J. H., 25
Localization, 1–2, 4, 6–7, 28–29, 55, 92, 444–447, 450–453, 467–468, 473–474
  in cases examined: amnesic aphasia, 305, 318–319, 450, 468, 473; apraxia, 347; expressive aphasia, 449, 468, 473; expressive-receptive aphasia, 449, 468, 473; receptive aphasia, 448, 449, 468, 473, 528; traumatic, 448, 528; tumor, 317–319, 447–448; vascular, 448–449
  with lesion in: angular gyrus, 23, 30, 106, 108; anterior central gyrus, 33, 104, 116; second frontal gyrus, 30; third frontal gyrus, 8–9, 10, 17, 30–31, 33, 55, 60, 61, 117, 435; Island, 71, 78; lenticular zone, 23; occipital lobe, 30, 68, 101, 107, 111; parietal lobe, 30, 60, 71, 105, 108, 114; supramarginal gyrus, 23, 78, 108; temporal lobe, 23, 82; first temporal gyrus, 10, 22–23, 30, 32, 33, 65, 71, 72, 117; second and third temporal gyri, 32, 61; transverse temporal gyri, 30, 32, 71

Localization (*cont.*):
  with lesion on left in right handed, 9, 17
  negative cases, 7, 322, 452
  views on: Bastian, 9–10; Broca, 8–9; Goldstein, 40–42; Head, 49; Henschen, 29–31; Jackson, 1, 14–15, 17; Kleist, 31–33; Marie, 20, 22–23; Mills, 24–25; Pick, 55–56; Wernicke, 10–11
  See also Right hemisphere, function of
Lotmar, F., 46–47, 79, 80–81, 98
Low, A. A., 60, 98
Luria, A. R., 34

Marburg, O., 58
Marie, P., 20–24, 25, 34, 37, 54, 56, 58–59, 65, 70, 76, 83–84, 118, 444, 461, 462, 464, 468
Marie's Paper Test, 573
Massary, J. de, 66, 68
McConnell, J. W., 506
Memory, 13, 21, 44, 336, 440–441
  tests of, 136, 589–590
Meyer, A., 24, 26–27
Meynert, Th., 101
Miles' A. B. C. Vision Test, 322, 594
Mills, C. K., 24–26, 98–99, 390
Mingazzini, G., 28
Monakow, C. von, 29, 58, 65, 94, 96, 101–102, 105, 107
Morlaàs, J., 112, 466
Morrison McCall Spelling Scale, 135, 326, 334, 578–579, 580
Motor amusia, 31, 116–117
Motor aphasia, 31, 50, 53, 54, 55, 78, 116, 464, 465
  localization of lesion in, 8–9, 10, 23, 30, 33, 60, 61
  nature of, 9, 20–21, 30, 32, 37, 38, 58–62
  transcortical, 61–62, 78
  See also Expressive aphasia; Pure motor aphasia
Moutier, F., 20, 21, 56, 57

Naming
  disturbances of, 23, 27, 32, 33, 46–47, 48, 52, 65–66, 69, 70, 71, 74. *See also* Amnesic aphasia
  tests of, 135, 568–569
Nativelle, M., 58
Nature of aphasia. *See* Psychological changes in aphasia, nature of
Niessl von Mayendorf, E., 29, 58, 61, 62, 469
Nominal aphasia. *See* Head, H., on nominal aphasia
Non-language performances
  in cases of right-sided lesion without aphasia, 324–326, 329, 330–332, 334–336
  cerebral basis of, 451, 453, 473–474
  disturbances of, 42–43, 153, 222, 279–281, 301, 360–363, 462, 467. *See also* Drawing, disturbances of
  in relation to language, 418–426
  tests of, 76, 103, 136, 338, 360–362, 590–594, 599–600
  well maintained in severe cases of aphasia, 279–281, 285–297, 548–554
Norms for tests, 577–578
Number Study, 580, 596–598

Occasional utterances, 12–13, 276
Occupational level, data on, 124, 125, 126–129, 130, 324, 328, 331
Occupational rating. *See* Barr Scale
Ogden, C. K., 388
Opposites tests, 136, 221, 278, 300, 332, 334–335, 581–582
Oral spelling test. *See* Gates Oral Spelling Test
Oral vocabulary test. *See* Stanford Binet Vocabulary Test
Orton, S. T., 574

Paragrammatism, 33, 44, 50, 53, 61, 70, 71–74, 465
  See also Receptive aphasia, expressive disturbances in
Paraphasia, 21, 27, 44, 52, 63, 70, 71–74, 75, 465
  See also Receptive aphasia, expressive disturbances in
Paraphrases, 217
Parietal syndrome, 44, 60, 108, 115
Part-Whole Test, 582–583
Paterson, J. V., 67
Pathological studies, 2, 4
  in cases examined, 305, 347, 447–448, 503, 506, 511, 528, 539, 556, 560, 562, 566
Pearson, G. H. J., 91
Pélissier, A., 67
Performance tests. *See* Non-language performances, tests of

Peripheral form of motor aphasia. *See* Goldstein, K., on pure motor aphasia
Perseveration, 70, 71, 75, 217, 219–222
  cases showing, 497–501, 501–505, 510–513
Personality, changes in, 40, 427–428, 459
Peters, W., 84
Pick, A., 8, 11, 19, 29, 76, 96, 101, 108, 469
  on grammatical disturbances, 60–61
  on localization, 55–56
  on sensory aphasia, 70–71, 73–74, 75
  on thought and speech, 42, 43, 51, 73–74
  on types of aphasia, 54, 56, 62, 78, 464, 465
Picture tests. *See* Non-language performances, tests of
Piéron, H., 73
Pintner Non-Language Mental Test, 136, 326, 330, 331, 332, 333, 591–592
Pintner Paterson Performance Scale, 136, 331, 335, 590–591
Pintner Toops Directions Test, 327, 331, 332, 575
Poliak, S., 445
Polyglots, aphasia in, 97, 160–182
Poppelreuter, W., 69, 84–86, 102, 105, 107, 111, 112, 113
Porteus Maze Test, 326, 330, 331, 333, 599–600
Pötzl, O., 29, 60, 64, 65, 66, 67, 68, 97, 107–108
Printed vocabulary test. *See* Thorndike Test of Word Knowledge
Propositional speech, 13–16, 35, 275–276
Proust-Lichtheim Test, 83
Pseudo-agrammatism. *See* Paragrammatism
Psychic blindness, 107, 110–111
Psychic deafness, 63, 106
Psychological changes in aphasia, 2, 3
  characteristics of tumor cases, 319–321
  contrasted with those of cases of right-sided lesions without aphasia, 329–330
  estimation of extent and nature of, 4, 456, 471–472
  extent of, 20–22, 34, 36, 40, 42–44, 141–142, 145, 426–429, 473
  nature of, 34–47, 413–441, 458–462, 473
Pure motor aphasia, 27, 31, 33, 52, 54, 55, 56–58, 182–183, 463, 464
Pure types of aphasia, 1, 27, 38, 51–52, 54, 55, 56–59, 62–70
  criticism of, 52–53, 67–68, 142, 463–464
Pure word-blindness. *See* Word-blindness
Pure word-deafness. *See* Word-deafness

Quadfasel, F., 89
Quensel, F., 103, 107

Ranschburg, P., 68, 69
Rate of speaking, 48, 71, 149, 216
Rate of work, 334–336, 423
Reactive speech, 148–149, 152, 276, 277, 415, 416–417, 460, 567
Reading
  in cases of right-sided lesion without aphasia, 324–325
  disturbances of, 10, 21, 23, 27, 30, 43, 48, 65–70, 215, 300; pronounced case of, 237–263
  tests of, 135, 136, 573–576, 595, 596
Receptive aphasia, 26–27, 51, 54, 118, 143, 144, 366, 430, 462, 464–465, 472
  cases of, 126–129, 222–236, 237–272, 513–546
  expressive disturbances in, 144, 146, 148, 215–221
  general behavior in, 222 213
  language intelligence in, 221–222
  nature of, 145–146, 221, 465
  non-language performances in, 222
  receptive disturbances in, 213–215
  relative severity of disturbances: of speaking and writing in, 216, 538–539; of understanding spoken language and reading in, 215, 237, 263, 538
  in tumor cases, 318, 320–331
Recurring utterances, 12, 276
Redlich, E., 66
Reeducation in aphasia, 92, 93, 97–98
  methods of, 98–99, 385–392, 472; illustrated in cases of aphasia, 177–178, 182, 231–232, 404–405
  results of, 407–411
  See also Learning, experimental studies of
Regularity in performance. *See* Consistency in response
Repeating
  pronounced case of disturbance of, 263–272
  tests of, 569–570
Reproduction of verbal material. *See* Memory, tests of
Retraining. *See* Reeducation
Ribot's Law, 96
Rieger, C., 83
Right hemisphere, function of, 14–15, 16–17, 61, 78, 95, 117–118, 452–453, 469–470

Right-sided lesions without aphasia, cases of. *See* Control groups, cases of unilateral cerebral lesion without aphasia
Roberts, W., 566
Round-about performances, 40, 42, 74, 94, 110, 437, 438

Salomon, E., 61
Sapir, I. D., 100
Schaffer, K., 77, 79
Schill, E., 68, 69
Schlesinger, B., 113
Schuster, P., 64
Semantic aphasia. *See* Head, H., on semantic aphasia
Sensible and Absurd Questions, 571
Sensory amusia, 116, 117
Sensory aphasia, 22, 31, 50, 53, 54, 55, 63, 464, 465
  conduction, 76–78
  localization of lesion in, 10, 22–23, 30, 32–33, 71, 72
  nature of, 10, 20–21, 70–78
  transcortical, 32, 76
  See also Receptive aphasia; Word-blindness; Word-deafness
Sentence Completion Test. *See* Kelley-Trabue Completion Exercise
Sentence Construction Test, 599
Series speech. *See* Automatic word series
Sherrington, C., 468
Simultanagnosie, 107, 108
Singer, H. D., 60, 98
Sittig, O., 59, 111–112, 115
Somatognosia, 114
Sound recognition, test of, 594–595
Souques, A., 58–59
Spatial orientation, disturbances of, 44, 49, 60, 65, 105, 108, 113–115
  See also Spatial thought, disturbances of
Spatial thought, disturbances of, 42–43, 45, 114, 116, 360, 362, 459
  See also Spatial orientation, disturbances of
Speaking
  disturbances of. *See* Amnesic, Expressive, Expressive-receptive, and Receptive aphasia: expressive disturbances in
  tests of, 135, 567–568
Spearman, C., 439–440
Speech center. *See* Cerebral centers, articulate language
Speech production
  disturbances of, 150–151, 276, 385–386, 432; pronounced case of, 183–188
Spelling. *See* Writing
Spiller, W. G., 25, 198, 303
Stanford Achievement Arithmetic Test, 135, 278, 331, 332, 333, 580–581
Stanford Achievement Dictation Test, 135, 332, 333, 578, 579, 580
Stanford Binet Scale, 330–331, 332, 333, 334, 573, 590, 592, 599
Stanford Binet Vocabulary Test, 136, 300, 326, 332, 333, 589
Stein, J., 68, 69–70, 102, 103
Stengel, E., 77, 97
Stenquist Mechanical Aptitudes Test, 600
Stertz, G., 64, 77
Stinchfield, S. M., 386, 569
Stolbun, D., 113
Storch, E., 67
Strauss, H., 102, 104, 105, 109, 113, 434
Structural confusions. *See* Receptive aphasia, expressive disturbances in
Subcortical motor aphasia. *See* Pure motor aphasia
Subcortical sensory aphasia. *See* Word-deafness
Symbolic formulation and expression, disorder of. *See* Head, H., on nature of aphasia
Syntactical aphasia. *See* Head, H., on syntactical aphasia

Tactile agnosia, 106, 339
Taguet, 67
Taterka, H., 64
Taussig Scale, 125, 126–129
Telegram style. *See* Agrammatism
Tests for agnosia, 102–103, 594–595
Tests for aphasia, 1–2, 3, 39, 45, 83, 91–92, 137–139, 456–457, 471
  arithmetic, 85, 87, 88, 135, 136, 580–581, 596–598
  automatic word series, 87, 135, 567–568
  color naming, 86, 88, 91, 458, 568
  drawing, 136, 592–594
  Goldstein's, 84–85
  Head's, 86–91, 458, 568
  interpretation of results of, 3–4, 89, 134, 471
  language intelligence, 136, 581–589, 599
  Marie's, 20, 83–84, 573
  memory, 136, 589–590

Tests for aphasia (*cont.*):
  Meyer's, 26
  naming, 86, 88, 91, 135, 458, 568–569
  non-language performances, 76, 85–86, 87, 136, 137, 590–594, 599–600
  norms for, 577–578
  object naming, 86, 88, 91, 458, 568
  physical work-capacity, 85
  Poppelreuter's, 84–86
  reading, 85, 86, 87, 88, 135, 136, 573–576, 595, 596
  repeating, 135, 569–570
  requirements of, 89, 132–134
  short batteries, 137, 139, 600–601
  speaking, 135, 138, 567–568
  understanding spoken language, 87, 88, 135, 571–573
  use in Germany during War, 84–86
  use of standard tests, 91–92, 457
  visual perception, 85, 102
  Van Woerkom's, 42–43, 86
  writing, 85, 87, 88, 135–136, 578–580
Tests for apraxia, 102–103, 344
Thorndike, E. L., 391, 439
Thorndike McCall Reading Scale, 135, 576, 580
Thorndike Test of Word Knowledge, 136, 589
Thorndike's Word Book, 388, 569, 571
Thought and speech, stages between, 42–43, 50–51, 73–74
Total aphasia, 11, 54
  See also Expressive-receptive aphasia
Training. *See* Reeducation
Transcortical motor aphasia, 61–62, 78
Transcortical sensory aphasia, 32, 76
Transfer of training, 99–100, 385, 411
Traumatic cases, 126–129, 154–160, 290–297, 505–510, 526–535, 548–554
Travis, L. E., 386
Trousseau, A., 7, 57
Tryon, R. C., 439
Tumor cases, 126–129, 302–316, 317–321, 501–505, 510–513, 538–546, 556–558, 558–560, 560–564, 564–566
Two-Factor Theory, 439–440
Types of aphasia. *See* Amnesic aphasia; Classification of aphasic disorders; Expressive aphasia; Expressive-receptive aphasia; Motor aphasia; Pure motor aphasia; Pure types of aphasia; Receptive aphasia; Sensory aphasia; Word-blindness; Word-deafness

Understanding spoken language
  disturbances of. *See* Expressive, Expressive-receptive, and Receptive aphasia: receptive disturbances in
  tests for, 135, 571–573
Usnadze, D., 46

Validity of tests, 133
Variability. *See* Consistency in response; Variations in performance
Variations in performance, 87, 413–418
  case showing pronounced, 558–560
  in tumor cases, 319–320
Vascular cases, 126–129, 160–182, 183–188, 189–194, 195–211, 222–236, 237–272, 281–290, 392–407, 475–501, 513–526, 535–538, 546–548, 554–555
Verbal alexia. *See* Word-blindness
Verbal amnesia, 9, 10, 54
Verbal aphasia. *See* Head, H., on verbal aphasia
Verbal confusions. *See* Receptive aphasia, expressive disturbances in
Vigilance. *See* Head, H., on vigilance
Visual agnosia, 65, 67, 69–70, 106–108
Visual apraxia, 105, 112, 113
Visual-spatial agnosia, 108
Visual word center. *See* Cerebral centers, visual speech
Vocabulary tests. *See* Stanford Binet Vocabulary Test; Thorndike Test of Word Knowledge

Wagner, W., 115
Weisenburg, T., 91, 98, 390
Werkzeugstörung, 45
Wernicke, C., 10–11, 24, 54, 72–73, 76–77, 78, 101, 113, 464
Wernicke's aphasia. *See* Sensory aphasia
Wertheimer, M., 67
Whipple's Opposites Test, 581
Willwoll, A., 46
Wilson, S. A. K., 38, 90
Woerkom, W. van, 39, 42–44, 46, 59, 73, 86, 92, 458, 462
Wolpert, I., 39, 44, 69, 107, 108
Woody Arithmetic Scales, 596
Word-blindness, 27, 30, 33, 37, 38, 52, 55, 62, 65–70, 110, 142, 463
Word-Building Test, 599

Word-deafness, 27, 30, 31–33, 37, 38, 52, 54, 55, 62–65, 116, 142, 463
Word-finding, disturbances of. *See* Naming, disturbances of
Word-muteness. *See* Pure motor aphasia; Anarthria
Work curves, 335–336
Writing
  in cases of right-handed lesion without aphasia, 324–326, 329, 333–334
Writing (*cont.*):
  disturbances of, 10, 21, 23, 27, 30, 33, 43, 44, 48–49, 59–60, 145, 146, 152, 216, 277; pronounced case of, 195–211
  tests of, 135, 136, 578–580
Wylie, J., 98

Zelmanowicz, J., 97
Zutt, J., 115

Aphasia, main
132 155W427a C 2
3 1262 03145 2294